THE ILLUMINATING ENGINEER

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

THE JOURNAL OF GOOD LIGHTING

OIL
GAS
ELECTRICITY
ACETYLENE
PETROL-AIR
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ETC.

OFFICIAL ORGAN of
The Illuminating Engineering Society
(Founded in London, 1909; Incorporated 1930)
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For Foreign Countries, 15/- per annum

Special Features:

Floodlighting at the International Illumination Congress—Progress in Illuminating Engineering—Lighting at the Colonial Exhibition, Paris—Lighting at the Faraday Exhibition—Lighting Literature, etc.

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Edited by
J. STEWART DOW

EDITORIAL AND PUBLISHING OFFICES:
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The Future of Floodlighting

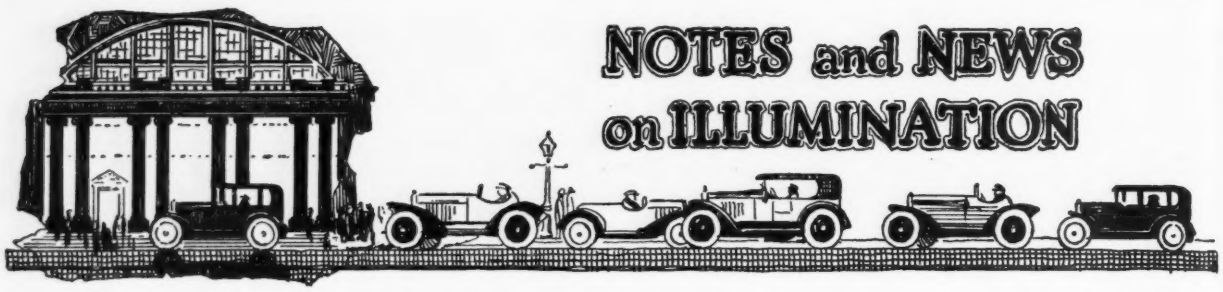
THE discussion on the I.I.C. Floodlighting, opened by Mr. Good at the meeting of the Illuminating Engineering Society, on October 30th, was an exceptionally entertaining one. Mr. Good paid a well-merited tribute to the work of the firms who helped in this outstanding display. We are glad that his own services in getting them together, and in so ably supervising the London programme, also received recognition at the meeting. It is also satisfactory to learn that the display has stimulated general interest in floodlighting, and has led to new installations throughout the country.

One point that has been strikingly demonstrated is the relative cheapness of floodlighting for purposes of publicity. (We may here digress a moment to repeat once more that all the expenditure on the I.I.C. floodlighting was borne privately, and that the Government was not asked to contribute a penny.) In the case of large stores and places of entertainment the expense involved is evidently of small moment in comparison with its advertising value. Mr. Good suggested other profitable applications—for example, as an aid to hospitals desirous of raising funds. But the most interesting applications are those designed to improve the appearance of a city by night, such as the illumination of public buildings of architectural distinction. Government expenditure in this direction must naturally be regarded as difficult during the present phase of stringent economy. Private generosity would here find a worthy object.

The most interesting portion of the discussion was that analysing floodlighting as an art. One was glad to have the comments of several architects whose co-operation in this field is welcome. It is, of course, hardly an objection to floodlighting to say that some buildings are better left in merciful darkness. One might say with greater justice that floodlighting, as compared with natural lighting, has the great merit of being under full control, and can therefore be confined to worthy objects. (The real difficulty would seem to be to secure unanimity amongst architects as to which buildings are deserving of treatment!) It is freely admitted that we have much yet to learn of floodlighting as an art, and that such matters as the relation of the direction of light to architectural ornamentation, so as to avoid unsightly shadows or unnatural "flatness," require study. We look to architects to help in this problem, firstly by analysing the principles involved and determining the conditions to be aimed at; and, secondly, by facilitating the application of artificial light to the exteriors of buildings erected under their supervision.

It is possible that lighting experts have in the past devoted themselves too much to technical calculations, and too little to what Mr. Bernard called the "inspirational" aspects of illumination. We freely admit that in floodlighting, as in most other fields of lighting, there are opportunities for the artist and for the man with the creative imagination. But there does seem a danger that —as occasionally happens in other "arts"—an appeal to inspiration may be used to cover mere vagueness of thought and lack of knowledge of detail. The early masters *did* undoubtedly concern themselves very closely with the materials they used, and the methods of applying them were regarded in a measure as trade secrets. Even in these days, great artists are not wholly indifferent to the implements of their craft. Illuminating engineering is still in the stage when implements have to be continually modified and developed: the technique of using these implements is progressing But for the efforts of illuminating engineers in perfecting these tools the inspirational user of floodlighting would stand a very poor chance to-day! The man who, when asked to light up a building, disregards all accumulated knowledge on such points as the desirable intensity of illumination, who has no knowledge how to measure light, and who proceeds by trial and error to find out "when it looks right," will waste a great deal of other people's time, as well as his own. Critical analysis, as contrasted with imaginative effort, often serves to show that an apparent defect has quite a simple explanation, as was illustrated in Mr. Ritchie's demonstration of the change in the appearance of Buckingham Palace according as the blinds were up or down!

In the immediate future we look forward to steady developments in the floodlighting of those types of buildings, mainly commercial, that it *pays* to illuminate. This, whilst perhaps not the highest development of the art, is an undeniably useful one. The second stage, the application of floodlighting to reveal buildings of architectural and historic interest by night may, we fear, progress but slowly until the national interest in economy is less acute. But this pause in progress affords an opportunity both to illuminating engineers and architects—the former to perfect their knowledge and equipment which will continue to prove indispensable, and the latter to study floodlighting and contemplate its possibilities as a vehicle for imaginative effort.



The Illuminating Engineering Society

FORTHCOMING EVENTS.

Readers will recall that on December 11th Sir Francis Goodenough is to deliver his Presidential Address to the Illuminating Engineering Society. The meeting will be held at the usual time (6.30 p.m.) in the hall of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.). Tickets will be distributed in due course.

We understand that the date and place of the Annual Dinner of the Society have now been fixed. This annual event, increasingly popular during recent years, will take place on February 9th, 1932 (the actual anniversary of the foundation of the Society), and will again be held at the Trocadero Restaurant (Piccadilly, London).

Thomas Alva Edison

The passing of Edison deprives the world of a great inventor, whose work was of incalculable benefit to mankind, and whose name was surely more familiar to the general public than that of any scientist of recent times. It is something of a coincidence that his death should have been reported almost simultaneously with the conclusion of the Faraday celebrations. In many ways no two men could have been more unlike; yet in each there was the same spark of divine fire. Michael Faraday was primarily a discoverer of scientific truths, an idealist delighting in new phenomena, and little concerned with their commercial application, which, indeed, was left mainly to those who came after him. Edison, whilst also a discoverer, was perhaps more remarkable for his marvellous insight in perceiving applications of new ideas, and for the fertile ingenuity and invincible industry with which he overcame all obstacles until they attained practical form. In a measure, each man was the product of his age. To each the world owes much.

A Street-lighting Report

An enterprising departure at the third Annual Research Meeting of the Institution of Gas Engineers, held in London during November 3rd and 4th, was the first report issued by the Street Lighting Committee, which was appointed about a year ago. The report emphasizes the importance of increased street illumination and the need for the gas industry to keep abreast of the latest developments in order to hold its own in this field. There is a useful summary of the British Engineering Standards Specification for Street Lighting in its amended form, and some practical hints as to how compliance with its terms may be most readily secured are included. For example, the advantages to be gained by increasing the height of light sources are illustrated by numerical examples, and figures are quoted to show how the latest directional devices enable the minimum illumination midway between lamps to be increased. Concluding notes deal with the advantages of automatic control of lighting, avoidance of glare, fog penetration, etc. Finally, some simple formulæ for the calculation of illumination are presented.

Heating of Cables connected to Gasfilled Lamps

A useful research on the above subject is being undertaken at the laboratories of the British Electrical and Allied Industries Research Association by a Sub-Committee, under the chairmanship of Mr. C. C. Paterson. The relatively high temperature of gasfilled lamps and their holders occasionally leads to deterioration of the rubber insulations of the first inch or so of the connecting leads emerging from the holder. The rubber becomes brittle and hard, and eventually cracks. In some fittings the safe working temperature, which should not exceed 50° C. for continuous operation, is only exceeded by a few degrees and little harm results; but if, as sometimes happens, a temperature of 100° C. is attained, deterioration may be comparatively rapid. The temperature depends on several variables, such as the design of the fitting and the dissipation of heat, the amount of heat flowing through the cap to the holder, and the temperature of the hot air in the convection currents rising from the lamp. An apparatus enables these currents to be shown on a screen and photographed. Various methods of reducing the temperature-rise are now being studied.

The International Commission on Illumination

LIST OF RESOLUTIONS.

The special article in our last issue (pp. 278-282) doubtless enabled readers to get a good general impression of the proceedings of the International Commission on Illumination and of the chief resolutions passed at the sessions. Those associated with the Commission have, however, with creditable promptitude issued a detailed list of resolutions for the benefit of those interested. There are about 80 separate resolutions and conclusions dealing with about 20 different subjects. This gives some indication of the manner in which the original scope of work of the Commission has extended. The number of problems is continually increasing, and there are numerous resolutions bearing on new topics, such as Lighting Education and Aviation Lighting.

Public Lighting Superintendents

CONDITIONS OF APPOINTMENT.

In our last issue we expressed some disappointment at the conditions of appointment of the lighting superintendent at Manchester. To prevent any possible misconstruction, however, we would like to make it quite clear that these comments were in no way intended to reflect upon Mr. James Sellars, who has accepted the Manchester appointment, and to whom we wish success in his new work. Readers will observe from the announcement that appears on page 325 that applications for the position of Public Lighting Superintendent at Nottingham are now invited, and it will be interesting to learn who is to succeed Mr. Sellars in that city.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Floodlighting for the International Illumination Congress

Proceedings at the Special Meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 6-30 p.m., on Friday, October 30th, 1931.

A SPECIAL extra meeting of the Illuminating Engineering Society was held at the house of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 6-30 p.m., on Friday, October 30th. Members assembled for light refreshments at 6-30 p.m., and the meeting commenced at 7 p.m., when the chair was taken by Lt.-Col. Kenelm Edgcumbe.

After the minutes of the last meeting had been taken as read, the Hon. Secretary announced the names of new applicants for membership, which were as follows:—

Corporate Members:—

Ackerley, R. O. .....Manager, Illumination Department, General Electric Co. Ltd., 32, St. George's Mansions, Red Lion Square, London, W.C.1.

Battie, D. C. .....Illumination Department, General Electric Co. Ltd., The Orchard, Ivy Lane, Woking, Surrey.

Percival, G. A. .....Lamp Works Manager, Kye Electrical Ltd., 8, Sherbrook Gardens, London, N.21.

Read, A. B. .....Director of Modern Fittings Design, Messrs. Troughton & Young, Elec. Contractors, 143, Knightsbridge, London, S.W.1.

Country Member:—

Halbertsma, Dr. Ing. N. A., Manager, Technical Publicity Department, N. V. Philips, Gloeilampenfabrieken, Eindhoven, Holland.

The names of applicants presented at the last meeting* were read again, and these applicants were formally declared members of the Society.

The CHAIRMAN then called upon Mr. PERCY GOOD, who had acted as Chairman of the I.I.C. London Committee, to give his address on **"Floodlighting for the International Illumination Congress: The Lessons to be Learned from it."** Mr. Good explained that the Council, recognizing the importance of the floodlighting display staged in connection with the Congress, had determined to devote an extra meeting to a discussion on future possibilities. He explained how the idea had originally developed, and how Government Departments and firms in the lighting industry had alike shown a sympathetic desire to help, and he described, with the aid of numerous lantern slides, some of the chief installations. Of special interest were the models of the Clock Tower and other buildings, which could be illuminated by miniature floodlights; the position of these sources being varied so as to give the effect of horizontal or oblique lighting, which again could be contrasted with the relatively diffused effect obtained by exposure to the general lighting in the room. Equally instructive was the series of photographs of buildings taken from approximately the same viewpoint by night and by day.

Mr. Good also discussed in some detail the shadow-effects characteristic of floodlighting, and the need for co-operation with architects, in order that the lighting might be adapted to revealing the architectural design of buildings of distinction. He quoted instances to show that floodlighting was a relatively inexpensive process, and discussed its future possibilities, not merely as a potent means of publicity, but as an agent that might enhance very greatly the appearance of a city by night.

In the subsequent discussion, Mr. HOWARD ROBERTSON, Mr. T. F. BENNETT, Mr. O. BERNARD, Mr. F. C. SMITH, Mr. E. STROUD, Mr. H. C. WHEAT, Mr. T. E. RITCHIE, Mr. L. G. APPLEBEE, Mr. J. I. HALL, and Mr. F. L. CALVERT took part; others who wished to join in the discussion were asked to send in their remarks in writing.

After Mr. Good had briefly replied to the discussion, a vote of thanks to him for his address was moved and carried with acclamation.

Before the meeting terminated the Chairman mentioned that the next meeting of the Society would be held on Wednesday, November 18th, at 6-30 p.m., in the Hall of the Tallow Chandlers' Company, 41, Trinity Square, London, E.C., when addresses would be given by Mr. Monier-Williams (Clerk to the Tallow Chandlers' Company), on "The History of the Hall and the Company"; by Mr. J. Swinburne on "The Early Days of Electric Lighting"; and by Mr. W. J. A. Butterfield on "The Historical Developments of Gas Lighting."

He also referred to two other events of interest to members of the Society, namely, the repetition of Dr. English's address (delivered before the Society in 1930) on "Glasses for Use with Invisible Rays," at the Science Museum (South Kensington), on November 20th; and the paper on "Street Lighting in Relation to Traffic," to be presented by Mr. Harold Davies at the Public Works Roads and Transport Congress on November 20th.

* *Illum. Eng.*, Nov., 1931, p. 283.

Progress in Illumination

(Report prepared by the Technical Committee of the Illuminating Engineering Society (Mr. A. W. Beutell, Chairman, Mr. A. Blok, Mr. H. Buckley, Mr. J. S. Dow, Dr. S. English, Lt.-Commander Haydn T. Harrison, Mr. W. J. Jones, Mr. E. L. Oughton, Mr. Howard Robertson, Mr. G. H. Wilson); presented at the Opening Meeting of the Society, to be held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C.2, at 6-30 p.m., on Tuesday, October 20th, 1931.)

Introduction.

IT has been for some time the custom of the Society to devote the opening meeting of the session to reports on progress and exhibits illustrating recent developments in illuminating engineering. The report now presented is the second undertaken by the Technical Committee. The procedure adopted last year led to the production of what was generally considered to be a materially improved report. It is hoped that the report now available will prove equally acceptable to members.

The Committee again followed the method of allotting different subjects to various members of the Society and others having special knowledge of the topics reviewed. In addition to the members of the Technical Committee, who are named above, the following gentlemen have assisted in this manner:—

Mr. J. G. Clark, Mr J. F. Colquhoun, Mr. A. Cunnington, Mr. H. N. Green, Dr. W. M. Hampton, Mr. J. Langdon, Mr. J. A. Macintyre, Mr. A. B. Read, Mr. Harold Ridge and Mr. H. T. Young.

The practice has again been followed of confining this report to technical and general developments other than those relating to the work of the Illuminating Engineering Society, which are dealt with in the Annual Report of the Council. The report has been confined to papers and events during the period September 1st, 1930, to October 1st, 1931, and has been devoted mainly to progress in Great Britain, though certain developments abroad which are of special interest have been mentioned.

The Committee desires to draw attention to the vast amount of information on progress included in the papers and reports submitted in connection with the International Illumination Congress and the International Commission on Illumination, which has not attempted to review in the present report. A partial survey, however, is being attempted in the Journal of the Society,* and the complete proceedings will be published eventually in volume form.

Generally speaking, the experience of the Committee has been similar to that reported last year, namely, that there are no very radical advances to record, though in most directions there is evidence of steady progress.

Gas Lighting.

The past year has seen a steady and positive development in Gas Lighting in its many applications. Improved reflectors conforming to the B.E.S.A. Specification are now becoming generally used for industrial lighting. Special small lighting units, in which the reflectors are directly associated with a suction ventilation duct (thus effectively combining the functions of lighting and ventilation), are being widely used. Greater use is also being made of reflectors of the "directive" type for poster and corridor lighting.

There has also been steady progress in the design of ventilating lamps for offices and public buildings and of interior fittings, bowls and other special units in harmony with modern architectural design.

Allusion is made elsewhere in this report to the landscape lighting of St. James's Park, which has given rise to a complete series of new lighting units, namely, (*a*) parabolic trough reflectors of stainless steel, (*b*) units applying the "controlens" system, (*c*) fittings using adjustable slats of stainless steel, (*d*) trough reflectors and (*e*) reflectors of paraboloidal form. Following the International Illumination Congress such special units have been widely applied for floodlighting and relief lighting of buildings throughout the country.

In connection with street lighting, with high or low-pressure lamps, a much greater use has been made of glass or stainless steel directional reflectors of single and multi-tier type, either used separately or in suitable combinations. Substantial progress has also been made in raising and lowering gear for centrally suspended lamps.

Electric Incandescent Lamps.

General Developments.

During the period under review, the use of Pearl and Opal obscured lamps in preference to clear lamps up to and including the 100-watt size has been extended. In the larger sizes also, clear lamps are giving place to obscured where used in open fittings, such as standard industrial reflectors. Substantial increases in the number of lamps produced and a more complete standardization of types has again aided a diminution in cost.

Coiled-Coil Filament Lamps.

The demand for lamps of comparatively low wattage with very concentrated filaments has led to the development of so-called "coiled-coil" filament lamps. This mode of construction is difficult to apply on a commercial basis, but a manufacturing process which enables stable lamps to be produced has now been perfected. The filaments of these lamps after being spiralled in the usual way are again spiralled, the result being a very compact construction. At the moment this type of lamp is being used mainly in connection with the "Home" type of cinema. The production of this coiled-coil filament lamp, consuming about 50 watts, has in fact turned the home cinema from an interesting toy into a serviceable piece of entertainment apparatus.

Heat-Resisting Bulb Lamps.

The development of heat-resisting glass has enabled lamps of high power, such as those of the 5 kw. size, to be fitted with comparatively small bulbs. This, although at first sight an improvement in detail has, nevertheless, had far-reaching effects. Thus, it has enabled lamps of this size to be used in light-projection and floodlighting equipment where previously the large bulbs necessary precluded their application.

Ultra-Violet Radiation.

A new type of lamp for the production of ultra-violet radiation has been recently developed. The new lamp has a tungsten filament sealed into a bulb in the ordinary way in parallel with two electrodes. The bulb contains a small quantity of liquid mercury which is vaporized when the incandescent filament is energized. In this manner the bulb is eventually filled with mercury vapour which permits an arc to strike across the electrodes in parallel with the filament. This lamp, consuming

* *The Illuminating Engineer*, September and October, 1931.

200 to 300 watts only, is stated to give off no radiation of very short wavelengths (such as might prove a source of danger if incautiously used) and yet to emit sufficient of those productive of sunburn to be equivalent in effect to the natural light obtained on an ordinary sunny day.

The lamp is controlled by means of a special transformer designed to control the filament voltage during striking up. Its object is not to cure disease but rather to provide an artificial source of sunlight so that the tonic effects of solar radiation may be enjoyed at any time.

Statistical Data.

The number of electric lamps used per head of population in Great Britain during the year was 1.05. This represents an increase of 17 per cent. as compared with the previous year; 61.2 per cent. of lamps sold were of the gasfilled type, as compared with 53 per cent. for the previous year. Standardization of electrical pressure has also had a material influence on the demand for lamps, as is clearly ilustrated in the accompanying diagram.

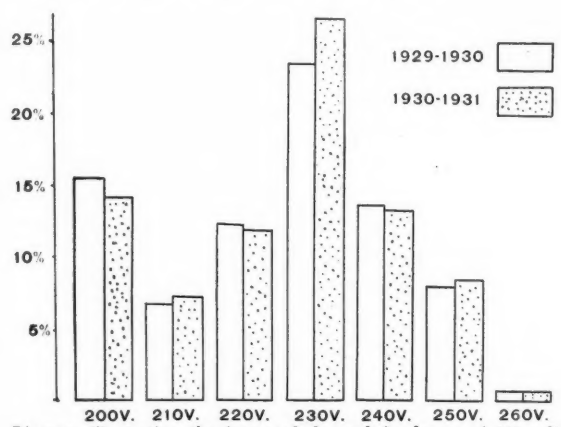


Diagram illustrating the increased demand for lamps of 230 volts during the past year.

LIGHTING EQUIPMENT AND ACCESSORIES.

During the 12 months under review development has once more proceeded along well-ordered lines. Although there has been considerable progress, there are no very striking novelties to record. Possibly the greatest development is to be found in the design of floodlighting units. A new type for *illuminating aerodrome landing-grounds* utilizes a fan-shaped beam, and is produced by the use of 1,000-watt tubular lamps lying along the line of focus of trough-like reflectors. The complete floodlighting unit normally consists of 9 single units.

Cornice lighting has received considerable attention, and in order to meet the special requirements of such a system of lighting, a number of " trough " reflectors have been designed. Models are available for use with either tubular lamps or one or two ordinary lamps. One design employs only one standard (g.s.) lamp for a reflector 3 ft. long.

In connection with the use of light for signalling purposes, there is a tendency on railways to change from the use of a double-lens combination to signals of the searchlight type. These utilize an ellipsoidal mirror concentrating the light on to a small coloured screen which is one of a set of three and is capable of being moved from one position to another by mechanical means. The light after passing through this filter is rendered parallel by a suitable lens. The advantages claimed for this system are smaller wattage lamps for the same axial candle-power, greater beam spread and avoidance of phantoms. For road traffic signals a reflector-lens system, which is said to have advantages over the earlier simple lens system, has been developed. Nevertheless the earlier system still has its adherents, and improvements in, and development of, equipment using it have occurred during the last year.

Interest in *street lighting* is unabated. During the year several single-piece prismatic refractors have been introduced and new types of two-piece refractors have also made their appearance. Improvements in long-burning flame arc-lamps for street lighting purposes are also to be recorded: the average period of burning for a pair of carbons is now approximately 150 hours; the specific consumption of the lamps is said to be between 0.2 and 0.3 watts per spherical candle.

Several new designs of *bulkhead* and similar fittings have appeared, and there has been improvement in old designs so that types of units superior to those available 12 months ago are now produced. Improvements in *vitreous enamel ware*, especially as regards durability and efficiency of reflection, have been made. Various new types of incandescent lamps have been recorded in the previous section; mention may, however, be made of another new form of *lamp for furnishing ultra-violet radiation*, namely, a mercury lamp enclosed within a globe of vitreosil. This translucent globe is stated to cut off the very short ultra-violet rays and only transmits strongly those radiations which lie within the solar spectrum.

Development is also to be recorded in connection with *Neon Tubes*. These can now be obtained giving a white light approximating to daylight in character, or a golden-yellow light of a much greater intensity than was previously possible. The so-called " ripple " tube, in which the column of light appears mobile instead of stationary, is a further development.

DOMESTIC LIGHTING.

More consideration continues to be given, not only by architects and decorators but also by members of the public, to lighting as a useful and decorative element in the illumination of buildings or rooms.

Lighting is becoming more and more an inseparable feature of a well-considered scheme and an integral part of interior and exterior architectural form, on which it now exerts a considerable influence.

Not only in public buildings, such as theatres, cinemas or hotels, but in private houses, rooms are now being designed to give the fullest possible value and quality to lighting. This attitude has given rise to new interior and exterior conceptions of form and colour.

In the home, fittings are becoming more and more simplified, especially in those parts of the house, such as the kitchen and bathroom, where efficiency is the chief consideration. Fittings for these positions are now made with clean majolica galleries threaded internally into which the opal glass shapes are screwed, rendering them dustproof and practically watertight.

In the dining-room and sitting-room, there is a tendency to combine indirect lighting with interesting direct sources of light, or to adopt direct forms of architectural illumination. Overhead lighting incorporated in the decorative scheme provides general illumination while table lamps, floor standards or wall brackets are introduced in order to serve as points of interest at eye level.

In new buildings architectural lighting is being widely introduced owing to the ease with which features of light can be formed when the building is

in progress of construction. Many existing rooms do not lend themselves to this treatment but high ceilings may be lowered and panels of light formed with excellent results.

Another outstanding development of the year has been the acceptance of tubular lighting as a useful and decorative element. Both the single and double-capped varieties of lamp can be used but the greatest possibilities are offered by the incorporation of delicately tinted opal tubes forming sheathes to the lamps.

School and Library Lighting.

Attention may be drawn to the issue of the reports of the sub-committees appointed by the Technical Committee of the Illuminating Engineering Society to deal with the above subjects.* Of special interest are the recommendations of (1) a minimum daylight factor of 0.5 per cent. in schools, (2) a minimum artificial illumination of 5 foot-candles for ordinary clerical work and 8 foot-candles for special work in schoolrooms and (3) a minimum artificial illumination of 5 foot-candles for reading purposes in libraries. The reports also contain recommendations on such matters as the avoidance of glare and the elimination of troublesome shadows.

The Lighting of Public Buildings.

Natural Lighting.

The most interesting developments in natural lighting of public buildings have been in connection with the lighting of picture galleries, where "top-side" lighting is becoming usual. A further example of this tendency is to be found in the new Courtauld wing of the Fitzwilliam Museum, Cambridge.† "Top-side" lighting is proposed also for the new Municipal Galleries at The Hague, whilst in the new galleries at Rotterdam a honeycomb ceiling made up of angled square or hexagonal boxes is contemplated. The outside pitched roof here will be mainly of glass and there will be a horizontal laylight. This form of lighting may also be adopted for the reconstituted Portrait Gallery, Edinburgh.

Artificial Lighting.

Efficient artificial lighting by means of concealed or unobtrusive units can be installed with any of these forms of construction. The series of trials in the National Gallery, Trafalgar Square, is nearing its conclusion. It seems probable that floodlighting by beams of central projectors at ceiling level may be adopted. Such an arrangement enables 6 foot-candles to be furnished at eye-level with a consumption not exceeding about 17 watts per foot run.

Another problem of interest which, like the preceding one, involves compromise is presented in the artificial lighting of the Armoury in the Tower of London. It would be easy to illuminate the armour by standard methods and the contents of cases by special lamps within them, but in so doing the building would be converted into a museum and the atmosphere would be lost. In the method ultimately adopted laylights serve the top rooms as sources of both natural and artificial light, and the lower rooms are lit by ceiling projectors directed mainly on the exhibits and heavily shielded so as to reduce glare. Partial "daylight" correction is applied. Progress in the lighting of other types of public buildings resembles that in other fields of lighting, though the advance is perhaps less rapid than in commercial buildings.

Industrial Lighting.

The general industrial depression has naturally affected adversely developments in industrial lighting, though, generally speaking, such new factories as are put up are being lighted in accordance with good modern methods. The results of a survey mentioned in the Report of H.M. Chief Inspector of Factories suggest, however, that conditions in old factories are still very far from satisfactory. Thus, glare was found to be in evidence in at least 95 per cent. of old factories devoted to fine engineering work. Instances of improvements in output of operators resulting from better lighting are mentioned. Thus in a foundry an increase from 2 to 7 foot-candles led to an increase of $7\frac{1}{2}$ per cent. in the bonus earned by the workmen. In another case the substitution of scientifically designed reflectors in the place of imperfect ones led to increases in output of as much as 60 per cent., besides diminishing eyestrain and headaches. Extreme tendencies in new design are illustrated by the report of the erection of a Factory in Fitchburg, U.S.A., without any windows; it was considered more economical and apparently sufficiently hygienic to rely exclusively on artificial lighting and ventilation.

Attention has been drawn to the lighting of coal mines in a statement made by the Secretary of Mines‡ mentioning new proposals bearing on the minimum candle-power standard for miners' lamps, the possibility of relaxing regulations affecting the use of electricity in mines, and the fixing of a standard for surface lighting.

Public Lighting.

The Annual Report of the Association of Public Lighting Engineers for the last year contains, as usual, an informative record of developments in about 50 areas which is supplemented by a useful summary of the chief tendencies revealed by these data. Attention is drawn to the greater number of lighting departments that now issue annual reports (those issued in Glasgow, Leicester, Liverpool and Sheffield seem particularly interesting), and the gradual additions to the number of public lighting departments under special officials. Features in lighting have been the general adoption of gas lamps containing more mantles per lamp or electric lamps of higher wattage, increased use of directive lighting, closer spacing in new streets, increases of mounting height in accordance with the requirements of the British Standard Specification, and the adoption and extension of automatic control of public lamps by clockwork or time-switches.

There is also a well-marked tendency towards supplementary public lighting, such as the erection of additional road or traffic signs, special warning lamps on refuges and islands, etc. Automatic traffic control signals are being installed in continually increasing numbers and in some areas (notably Edinburgh) definite evidence of the diminution of accidents following their introduction has been secured.

The Association has been devoting attention to the collection of information bearing on the relation between street accidents and lighting conditions. There have been several recent reports on this subject, notably those prepared for the Département de l'Oise, France, and by K. M. Reid and A. H. Hinkle in the United States. Both researches tend to establish the relation between lighting and street safety and the suggestion has been made that in any given locality the ratio between night and day accidents may furnish a criterion of considerable interest.

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* *The Illuminating Engineer*, July, 1931, pp. 155-161.

† *The Architect and Building News*, June 5th, 1931.

‡ *The Illuminating Engineer*, February, 1931, p. 35.

A revised version of the British Standard Specification for Street Lighting (B.S.S. No. 307, 1931) has recently been issued. Features of interest are (1) the inclusion of footway illumination, (2) the adoption of "recommended" heights of posts in addition to minima, (3) the insertion of maxima and recommended values for "spacing ratios," (4) provision for a statement of the calculated average illumination and (5) the absence of any numerical expression for glare, and the substitution of general guidance on this subject. (A review of this revised specification was presented by Mr. C. C. Paterson at the International Illumination Congress.)

Railway Lighting.

Lighting on the railways during the past 12 months has been marked by the completion of several large floodlighting installations, projectors being installed on the parallel opposed system, with special supplementary lighting for the "Hump" section. A distributive system of floodlighting has been installed at one of the large docks and has produced satisfactory results. The projector unit used in the schemes mentioned is fitted with a vitreous enamelled vizor so that "top" light is utilized.

The use of "directive fittings" has been further extended in some districts, particular use being made of an elongated distribution for station platforms at country stations where it is desired to avoid waste of light on grass banks and private property at the back of platforms.

Trials have been made with a very useful form of portable floodlight operated with a vaporized oil burner. This has been found most useful for permanent way work where no supply of gas or electricity is available and it seems likely to prove satisfactory.

A further application of acetylene burners has been made in the lighting of tunnels. Several tunnels have been equipped with a small bore pipe line and jets at intervals, the actual source of supply taking the form of one or two flare-light generators usually fixed at either end of the tunnel.

Lighthouse Illumination

An outstanding development of the year has been the Multi-phase Optic built to the requirements of Trinity House (Brit. Pat. 330, 275). This ingenious apparatus is intended primarily as a standby for various lightships which are provided with dioptric apparatus. The optical system consists of a number of panels so designed that, by assembling them in different orders, they may be arranged to give either single, double, triple, or quadruple flashes, or, alternatively, single flashes in two colours. Thus the one standby apparatus can be used for any existing lightship, avoiding the old method of keeping spare lightships in case of emergency. The convenience and financial saving are obvious. One or two sets of this apparatus have already been built and are giving good service.

At Portishead Point on the Bristol Channel an unwatched automatic lighthouse has been established.

Aviation Lighting.

Certain types of aviation lighting equipment have now reached a stage in their development at which their performance leaves little to be desired. The landing floodlight, for example, will adequately illuminate an area of sufficient extent to allow any aircraft to be landed safely. In the case of these units development is continuing not so much to increase their efficiency or luminous output but to decrease the first cost of the apparatus, to increase reliability of operation and to lower maintenance costs.

A tendency is noticeable to employ either silvered-glass mirrors or moulded lenses in place of the more expensive optically worked lenses and to use several light sources in place of one large source. A landing floodlight has recently been built consisting of a bank of nine trough reflectors of parabolic section each equipped with a 1,000-watt line filament lamp; another type consists of three sections of a moulded 4th order lens assembled as a single unit and equipped with three 1,500-watt rectangular filament lamps.

Considerable attention has been given to the question of the correct light distribution of airway beacons. In the lighting of British air routes no attempt has been made to instal a chain of beacons which a pilot can follow in the same way that a driver is guided by street lights. The policy is rather to provide relatively powerful beacons with such a light distribution that in the worst visibility in which flying is normally undertaken a pilot, navigating with ordinary skill, will be certain to pass within range of each beacon along the route. The beacon in bad visibility acts as a visual check on navigation and enables the pilot periodically to make any necessary corrections to his course.

A 4th-order dioptric beacon, designed to comply with the above requirements, has recently been installed at Merstham on the southern route from Croydon Airport to the Continent. The main beam intensity is 75,000 candles and the intensity in the upper angles is such that the useful range is approximately two miles when atmospheric transmission is 2 per cent. per mile.

An important decision has been taken regarding the light character of airway beacons. It is customary to give a beacon a flashing character consisting of a letter of the Morse alphabet, by means of which the location of the beacon is conveyed to the observer.

It was realized that the number of simple Morse characters is limited and that the eventual multiplication of lighted airways might result in relatively closely adjacent beacons having the same light character, with a possible risk of confusion. (The objections to the use of long Morse characters are that they either take up too much of the pilot's time to read or alternatively they must be exhibited so quickly that they are difficult to identify and lose in apparent intensity.)

It is therefore proposed that all beacons on a given route or section of a route should be allotted the same light character, with auxiliary lights for location identification where necessary.

Theatre Lighting.

There is litte to report in connection with novel lighting equipment for theatres. Modern methods of scientific lighting and colour-mixing are, however, becoming more widely adopted and there has been improvement in detail. During the year two large London theatres (the Coliseum and the Alhambra) have been equipped with the movable type of cyclorama with supplementary lighting based on a well-known German system, and they have also made considerable additions to their normal lighting systems.

As an instance of progress in "little" theatres it may be mentioned that the Halifax Building Society in their new Alexandra Hall at Halifax have installed a permanent cyclorama and three-colour system of British design and manufacture. The dimmers controlling this installation are of improved design. giving an output in lumens proportional to the travel of the dimmer.

The most noteworthy advance in apparatus is that installed in the Opera House at Cologne where Herr Hans Strobach has successfully developed a new system of projecting scenery from lantern slides.

Illuminated Signs.

An outstanding development in illuminated signs has been the progress made in the use of luminous neon tubes. Although certain varieties of colours additional to the familiar red, green, and blue have been known for some time it is only recently that such tints as gold, white, and salmon-pink have become commercial propositions. The sizes of electrodes have been reduced so that these can be concealed, for example in countersunk tubes. There is a tendency towards the use of materially lower voltages. Signs now frequently operate at approximately 2,500 volts to earth as compared with 10,000 to 12,000 volts from the older types of transformers. Signs are becoming more reliable and maintenance has become much simpler. A novelty has been the sinuous displacement of the luminous discharge, giving rise to a flickering effect. Flashing on the low-tension side presents no difficulties, but flashing on the high-tension side, which alone will be satisfactory for intricate animated effects, is as yet in the experimental stage.

The possibilities of pictorial effects with neon tubes are now becoming better appreciated and they are being more widely used in combination with incandescent lamps. The trough letter sign has been to a great extent superseded for the mere presentation of names or words, but there has been extension of the use of large written signs or pictorial posters illuminated by concealed floodlight projectors. Box signs are becoming more artistic in form and contour.

The practice of making use of travelling electric flashing signs, carrying with them their own generators, has become more usual, and this idea seems capable of considerable development. Amongst signs of a more original nature may be mentioned those executed in fluorescent materials which become luminous under the action of ultra-violet rays. Posters of this description have been previously recorded, but they seem to be becoming more widely used.

Floodlighting.

The floodlighting achievements of the past year are summarized in the installations erected for the International Illumination Congress during September,* ranging from quite small installations using quite moderate illumination to big schemes in which the values were extremely high. In most cases the installations had been carefully designed so that a maximum of relief was obtained and the architectural features were shown to the best advantage.

The values of illumination in use are steadily rising. In the case of the permanent installation on Nottingham Council House tower, an illumination of 40-50 foot-candles has been recorded. On the frontage of Buckingham Palace the illumination during the Congress was 20-30 foot-candles. In order to obtain such high values, however, hundreds of projectors may be necessary.

Another new departure for this country is the use of mobile colour lighting. At the Mornington Crescent factory of Messrs. Carreras Ltd., an automatically controlled scheme has been installed. Red and green beams illuminating the columns and front of the building are faded in and out gradually so that a dissolving effect is produced.

The floodlighting of gardens has become more popular in the last year. An outstanding example of the success with which this may be done was afforded by the gas lighting of the flower gardens in St. James's Park during the period of the International Illumination Congress and the Faraday celebrations. Railway yard floodlighting has also developed and many examples may now be seen in this country. French practice in this direction has been described in a paper presented to the Congress meetings at Buxton.

There has been a general improvement in the design of floodlight units. One new departure, the evolution of a gas floodlight, is no small achievement. The chief problems involved in the design of these special units have been (1) the concentration of the beam, (2) the design of mechanical arrangements for securing the lamp at any angle or in any position and (3) the provision of a unit with adequate ventilation and facilities for maintenance which would at the same time be wind and rain proof. Successful units appear to have been constructed, although development work is still proceeding. Chromium-plated copper and stainless steel have been stated to be suitable for the reflecting surface.

Projectors for electric light continue to use silvered glass, chromium-plated or stainless steel reflectors. In many cases greater robustness in construction has been obtained and such features as focussing devices and "locators," which enable the flood to be returned to its normal position after cleaning, have been incorporated in the designs.

Photometry and Colorimetry.

Standards of Candle-power at Tungsten Colour.

A number of important researches in photometry and allied subjects have been reported during the past year, and the data presented at the sessions of the I.C.I. at Cambridge were of outstanding importance. Of special interest is the result of the meeting of the representatives of the national laboratories of France, Germany, Great Britain and the United States during these sessions. A programme of work was drawn up in 1927. Owing to differences in the standards of candle-power at tungsten colour issued by these laboratories, the laboratories agreed to measure the transmission of four blue glasses which would alter the colour of the radiation from carbon lamps to identity with that from tungsten lamps. Three different methods were used by each laboratory. Following a discussion of the results at Cambridge it was agreed that the spectrophotometric method combined with the agreed visibility curve gave the most consistent results. The laboratories have agreed to bring their standards into agreement by means of blue glasses the transmissions of which shall be determined by spectrophotometry. The results obtained by the National Physical Laboratory and the Bureau of Standards for the spectrophotometric and flicker photometer methods were extremely close. The results of the four laboratories for the direct comparison method with a Lummer Brodhun photometer varied over a range of about 3 per cent.

Liquid Filters for Photometry, Colorimetry, etc.

Davis and Gibson† have presented extensive data on the transmission properties of coloured solutions of two types, in one of which the colour is due to copper sulphate and in the other due to a mixture of copper sulphate and cobalt ammonium sulphate. These solutions are used in two compartment cells and are reproducible from specification. They should be of great utility in photometry, colorimetry and photographic sensitometry, for the accurate production of radiations of various colour-temperatures from gasfilled lamps of known colour temperatures.

Professor Fabry presented at Cambridge a record on the development of heterochromatic photometry

* *The Illuminating Engineer*, September and October, 1931.

† Davis and Gibson, Bur. of Stds., Misc. Pubn., No. 114, 1931.

during the past three years; Dr. J. F. Meyer dealt with the maintenance of the international candle. It appears that the unit of candle-power at the National Physical Laboratory is in agreement with that at the Bureau of Standards; the unit in France is about 1 per cent. greater and in Germany about 1 per cent. smaller (if the Hefner candle is assumed to equal 0.9 international candle).

Messrs. Dudding and Winch at the meeting of the International Illumination Congress presented a paper on the accuracy of commercial photometry, illustrating the high degree of precision which is reached in routine lamp testing at a factory using well-designed photo-electric photometers.

Two papers on colorimetry by Guild* have appeared during the past year. The first, which deals with the fixed points of a colorimetric system, discusses the general principles of colour standardization and the second the colorimetric properties of the spectrum and the colour properties of the average eye. The results are closely in accordance with those obtained by Wright but differ from those of König. At the recent meeting of the International Commission on Illumination the mean of Guild and Wright's results was adopted in principle as representing the standard observer for colorimetry.

Instruments.

Townend† has described a mechanical integrator for determining the daylight factor at any point in a room due to the daylight received there from windows in the walls or roof.

A visibility meter has been devised by Bennett.‡ It measures the degree of clearness with which an object can be seen. Very slightly ground glasses are introduced into the field of vision and the number required to obscure the object is a measure of its visibility. The author indicates the use of the instrument in meteorological work and also in illuminating engineering.

A photometer eye-piece utilizing Maxwellian view has been described by Preston.‖ By the use of interchangeable lenses and eye rings, the eye-piece can be used over a wide field of usefulness particularly for brightness measurements of very small areas.

Miscellaneous Research.

Research has been in progress in the fundamental principles and technique of light-production in the applications of light to practical problems.

Electric light-sources are being investigated from two points of view. The hot-cathode discharge lamp has received considerable attention on account of its value as a source of coloured light of high efficiency, and ultra-violet lamps are being studied because of their probable value to health.

Papers by Harris and Jenkins§ and by Pirani and his co-workers in Germany¶ have indicated the possibilities of these gaseous discharge lamps. Daylight effects have been produced by a combination of incandescent lamps and gas discharge tubes and approaches to white light have been obtained by mixing the light from various tubes. Investigations are still being carried out on these sources of light.

Lamps coming within the second class, namely, those for the production of ultra-violet as well as visible light, have been described within the last year abroad* and such lamps are already available in this country. The type described in the above references utilize a mercury arc between tungsten electrodes, but later communications have described a simple filament lamp which radiates a small amount of ultra-violet by reason of the special glass bulb in which the filament is mounted. The subject of ultra-violet illumination was raised in a thorough way by the Dutch Committee at the International Commission meetings in Cambridge and certain aspects of the question are now to be studied by the Commission.

Research in gas burner construction has been continued, and in a paper presented to the Congress at Edinburgh† a form of scientifically designed burner which will operate at maximum efficiency with a gas of certain calorific value has been described. The ejector is so designed that the gas leaving it has a maximum of kinetic energy and the flow is as smooth as possible.

In the field of applications of light, research in Great Britain may well be summarized in the publications of the Technical Papers of the Department of Scientific and Industrial Research. The following four papers are the more recently published:—

No. 10. The Effect of Distribution and Colour on the suitability of Lighting for Clerical Work.

No. 11. The Efficiency of Light-Wells.

No. 12. The Daylight Illumination required in Offices.

No. 13. Appraisal of Street-Lighting Installations.

The work on glare and visual capacities which has been undertaken at the National Physical Laboratory‡ is proceeding.

In Germany Klein‖ has described an apparatus for the determination of "seeing power" by means of measurements of glare effects.

Fundamental investigations on the scattering of light have been made by three or four workers, notably Dreosti§ and Ryde and Cooper.¶ The last two authors have devised a method of assessing the merit of an opal glass by certain fundamental constants derived from the theory and the question is to be studied internationally.

Lighting Education.

Lighting Education, which formed the subject of a comprehensive report to the International Commission on Illumination at Cambridge, is becoming a topic of considerable importance, and accordingly a section is being devoted thereto in the present report.

The survey made by the Lighting Education Sub-Committee mentioned above embraced a considerable number of countries, in some of which (such as the United States) lighting education has reached a relatively advanced stage. In this country matters are in some respects well advanced but in others undoubtedly backward. There is doubtless ample justification for the recommendations approved at Cambridge which included, amongst other proposed steps, the inclusion of instruction in illuminating engineering at post-primary schools and architec-

* Guild, Trans. Opt. Soc., Phil. Trans., (A), 230, p. 149.
† Townend, J.Sc.Insts., VIII, p. 177, 1931.
‡ Bennett, J.Sc.Insts., VIII, p. 122, 1931.
‖ Preston, J.Sc.Insts., VIII, p. 199, 1931.
§ Abstract No. 88, June, and continuation.
¶ Abstract No. 63 and Paper 51 to the International Illumination Congress.

* Abstracts Nos. 2 and 3, March.
† Paper No. 72.
‡ N.P.L. Annual Report, 1931
‖ Abstract No. 124, July.
§ Abstract No. 77, June.
¶ Papers Nos. 8 and 9 to the Illumination Congress.
¶ Proceedings of the Royal Society A., 1931, Vol. 131, pp. 451 and 464, and papers to the International Illumination Congress.

tural colleges, and the establishment of at least one full specialized course in illuminating engineering.

At present the instruction in illuminating engineering given at technical colleges takes the form of a series of lectures, usually not exceeding six, supplemented by a small amount of laboratory work. A special field for work undoubtedly exists in connection with courses for architectural students, whilst lighting experts, too, could benefit by instruction in architecture. Attention has been drawn during the past year to the newly established course of four special lectures for architectural students conducted by Professor W. C. Clinton at University College, London, and to similar series of lectures which have for some years been delivered to the Architectural Association and at the University of Liverpool. But it is evident that, so far as technical colleges are concerned, much remains to be done.

A considerable amount of lighting education is being carried out in the form of lectures to industrial and trade bodies, especially in connection with the Home Office Factory Department; the addresses delivered by Mr. D. R. Wilson and Mr. J. S. Dow before one of the Management Research Groups of Great Britain in November last, which were followed by visits to good modern office and factory lighting installations, are typical of such work.

It is evident that the chief burden of educational work in connection with lighting is borne by organizations associated with the lighting industry. Watson House has been for many years an established centre for the training of gas engineers. The two floors devoted to demonstrations of lighting equipment during recent months, which were visited by members of the International Illumination Congress, represented an enterprising departure. One floor was devoted to two dozen booths each containing a distinctive lighting fitting, with a polar curve of light distribution and notes on its chief applications. The other floor was fitted out as a model street and on which were mounted posts terminating in gas lamps equipped with a number of forms of prismatic glass directive devices, some of quite recent introduction. The E.L.M.A. Lighting has, through the medium of Lecture Demonstrations, Illumination Courses, Lighting Campaigns and Exhibitions, continued its educational activities.

During the autumn of 1930 and the spring of 1931 Illumination Design Courses were conducted at the Bureau, the former consisting of seven weekly lectures and the latter of a day course of a week's duration.

New activities initiated during the year included lectures on lighting as part of the regular fifth year course for students of the Architectural Association, and in connection with the Domestic Science Mistresses' Summer School, organized by the Board of Education. In addition about 300 lectures to a total audience of 10,000 have been given in the Bureau and in provincial cities during the 12 months ending September, 1931. The Bureau has also arranged for local courses on lighting for architectural students in various towns throughout the country.

A Shop and Display Lighting Campaign was conducted jointly with the British Electrical Development Association in the autumn of 1930 when about 200,000 shopkeepers received lighting literature of an educational nature, 80 lectures on shop lighting were delivered and competitions for the best-lighted window were organized in 30 towns.

The two Provincial Bureaux have continued their active local work. The Scottish Bureau, has devoted itself specially to good lighting for the home: the Manchester Bureau to educational lighting work for supply undertakings.

Conferences and Exhibitions.

Conferences and exhibitions during the past year have been somewhat overshadowed by the International Illumination Congress. Allusion has been made to the unprecedented display of floodlighting which accompanied the Congress. Reference may also be made to one feature of the Faraday Celebrations—the remarkable indirect lighting of the Exhibition at the Albert Hall. Beams of light from 200 concealed projectors illuminated a vast overhead canopy, from the centre of which descended a luminous cylindrical fitting, likewise composed of white and yellow fabric and illuminated from within. The large central fitting consumed 27 kw., and the 32 "half-lanterns" of similar design, ranged round the hall, an additional 16 kw. The complete lighting load was 243 kw. and the illumination in the body of the hall was stated to be about 15 foot-candles.

Amongst exhibitions abroad mention may be made of the electrical displays held in Stockholm and Copenhagen, the Centenary Exhibitions in Brussels, Anvers and Liège, and the Colonial Exhibition in Paris. The lighting in each case presented original features, notably the Colonial Exhibition in Paris where specially designed indirect units were almost exclusively employed.

Association of Public Lighting Engineers

Forthcoming Conference in Blackpool.

We understand that the next conference of the Association of Public Lighting Engineers will be held in Blackpool during the week commencing September 5th, 1932. Several interesting papers are already in prospect, but the Council is sitll on the lookout for other contributions, and the Hon. Secretary (Mr. J. S. Dow, 32, Victoria Street, London, S.W.1), will be glad to hear from any members prepared to read papers or to make suggestions in regard to subjects.

We take this opportunity of reminding members of the good work which the Association is doing. Membership is confined to engineers in charge of public lighting, but those who, whilst not professionally responsible for public lighting, are interested generally in the project of improving the lighting of our streets are eligible to join as associates. The annual conference, held each year in a different city, is always a pleasant and instructive event, and the Association is responsible for other occasional meetings, such as that held last month in connection with the Public Works, Roads and Transport Congress. The A.P.L.E. is as yet a young body, but it has doubtless a future before it. There must be many engineers and officials who are qualified to join as members, but have not yet done so, and many others who, as associates, would get much pleasure and interest from the Association's gatherings.

Presentation to Mr. S. B. Langlands.

A very pleasant event, on October 22nd, was the representative gathering of employees and staff of the Corporation of Glasgow Public Lighting Department to celebrate the completion of 25 years of useful service by the Inspector of Lighting, Mr. S. B. Langlands. Bailie Macfarlane presided. Bailie Macdougall, in presenting to Mr. Langlands three silver bowls, spoke very warmly of the long, able and faithful service that Mr. Langlands had rendered to the Corporation. Mr. Langlands, in responding, recalled many instances of kindly feeling on the part of members of the staff that had contributed greatly to the efficient working of his department, and praised the manner in which they had risen to all demands made upon them.

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

(*Continued from page* 293, *November*, 1931.)

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. H. M. Cotteril, Mr. J. S. Dow, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. W. C. M. Whittle and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

I.—RADIATION AND GENERAL PHYSICS.

220. A Correlated Colour Temperature for Illuminants. R. Davis.

Bureau of Standard Journal of Research, 1931. 4, 659.

Most artificial and natural illuminants do not match exactly any of the Planckian colours. Strictly speaking, therefore, they cannot be assigned a colour temperature. A correlated colour temperature may be determined by comparing the luminosities of each of the three primary (red, green and blue) components of the source with similar values for the Planckian series. The red component of the source corresponds with that of the Planckian radiator for one particular temperature; the green and blue components for other temperatures. The average of these three component temperatures is designated as the correlated colour temperatures.

S. E.

221. A Simple Black Body. G. Liebmann.

Zeits. f. techn. Physic. 12. *pp.* 433-5. *No.* 9. 1931.

The approach to a true black body of a heated tube with a slit running its length is first discussed. A description is given of such a source which has been constructed and is in use for spectrometrometry.

G. H. W.

222. Observations on the Basic Eye Sensitivity Curve. H. Schulz.

Zeits. f. techn. Physic. 12. *pp.* 421-4. *No.* 9. 1931.

There is not as yet any theoretical basis upon which the eye sensitivity curve can be obtained by using only physical constants. By the assumption of a simple formula similar to Wien's law, values for the sensitivity curve have been calculated, and the results are compared with standard curves.

G. H. W.

223. On the Sensitivity of a Copper Oxide Photo-electric Cell of the Copper Gauze Type and a Comparison with the Optical Absorption and Photo-Conductivity of Cuprous Oxide. L. Dubar.

Comptes Rendus. 193. *pp.* 659-661. *19th Oct.*, 1931.

Reference is made to a copper oxide cell previously described, and new data is given on the performance of the gauze type. This cell responds to the red and infra-red regions of the spectrum.

S. S. B.

II.—PHOTOMETRY.

224. Universal Photometer. Anon.

Electrician. 107. *p.* 169. *13th Nov.*, 1931.

Details are given of photometric equipment designed to facilitate the preparation of polar distribution of fittings. Fittings under test can be rotated about their axis in order to obtain average results, and a system of mirrors is used in conjunction with a long bench. An adjacent passageway in line with the bench may be used for projector units. C. A. M.

225. A Graphical Determination of the Illumination produced by Light Sources of Large Area.

E.u.M. Lichttechnik. No. 6. *pp.* 49-52. *1st Nov.* 1931.

A simple graphical method is developed for the determination of the illumination produced on a plane from a light source of large area. In addition, it is shown how to calculate the number and size of incandescent lamps used behind a glass screen in order to produce a given illumination. G. H. W.

226. A Self-recording Spectrometer. H. M. Randall and John Strong.

Rev. Sci. Instruments. 2. *pp.* 585-599. *Oct.*, 1931.

The instrument described covers the spectral range accessible by prisms or gratings. The spectrum is made to pass over a thermopile, and the resulting galvanometer deflections are recorded photographically. F. J. C. B.

227. The Spectral Integrator, an Apparatus for the Calculation of Colours from Spectral Data. S. Rösch.

Zeits. f. techn. Physic. 12. *pp.* 410-417. *No.* 9. 1931.

It is possible to obtain the analysis of a colour by an optical multiplication and integration of the curves for the three primary colour stimuli and the spectrophotometric curve of the colour being analysed. The apparatus described integrates by means of rotating sectors, the apertures of which are stencils of the spectrophotometer curve, and neutral filters which modify the eye-sensitivity curves. E. S. B.-S.

228. On the Basis of the Method of Colour Measurement due to Bloch.

Zeits. f. techn. Physic. 12. *pp.* 418-421. *No.* 9. 1931.

After a comparison of the methods due to Bloch and Ostwald, the errors in filter methods are discussed in general and with special reference to Bloch's proposals. It is not possible to convert Bloch's values to those obtained by Ostwald, but it is possible to devise a method which, whilst retaining the basic principles of the Bloch method, is suitable for practical use. G. H. W.

229. Contribution on Colour Measurement. A. Dresler.

E.u.M. Lichttechnik. No. 5. *pp.* 41-46. *Aug.*, 1931.

Discusses the three-colour filter method of Bloch in the light of the Young-Helmholtz theory.

G. H. W.

230. Highly Sensitive Vacuum Photocells. M. C. Teves.

Z.T.P. 12. *p.* 556. 1931.

Description of the latest improvements in vacuum photocells obtained by experiments on the photocathode. The use of alkali metals, especially caesium, with sublimed chemical salts in addition, displaces the red wavelength limit advantageously.

E. S. B.-S.

III.—SOURCES OF LIGHT.

231. Artificial Sunlight. Anon.

Electrician. 107. *p.* 653. *Nov.* 13*th*, 1931.

Details are given of a new type of lamp producing ultra-violet radiation, developed by the Westinghouse Lamp Co., designated G.1. The consumption is around 2 amps. at 20 volts, and it is designed to operate either with a transformer or a series lamp. The lamp contains two oxide tubes heated internally by a wire coil. C. A. M.

232. Arc Lamps in Cinemaphotography. T. Thorne-Baker.

El. Rev. 109. *p.* 696. 6*th Nov.*, 1931.

The arc lamp which, since the advent of talking pictures, has been largely replaced by gasfilled lamps, now shows signs of again returning to favour. For coloured films it is necessary both to take the picture and to project it, using light as near as possible to the colour of daylight, and the modern arc can be made to do this. G. S. R.

233. Inbuilt Cutouts. W. E. Clemson and H. G. Schiller.

Light. 2. *p.* 28. *Sept.*, 1931.

An announcement is made that series-burning lamps of 2,500 lumen, 4,000 lumen and 6,000 lumen rating are now available in America with the cut-out built inside the lamp cap. Diagrams are given. The performance up to the present has been found to be satisfactory. With these lamps there will be no need for the special type of lampholder with external cutout at present necessary with series lamps, if further tests show that they are completely satisfactory in all conditions of service. C. A. M.

IV.—LIGHTING EQUIPMENT.

234. Boundary Lights for Aerodromes. H. Walter.

A.E.G. Mitt. No. 11. *pp.* 664-68. *Nov.* 1931.
Licht u. Lampe. 20. *pp.* 321-23. *Oct.* 29*th*, 1931.

After a review of the present position in regard to boundary lighting in various countries, modern forms of A.E.G. neon and incandescent lamp boundary lights are described. Circuit diagrams showing the cable layout round the aerodrome for both types of lamps are given. G. H. W.

235. Illustrations of Lighting Fittings.

El. Rev. 109. *pp.* 591-2. *Oct.* 16*th*, 1931.

Two art pages of the latest lighting fittings by various firms are given, together with a brief description of each photograph. G. S. R.

V.—APPLICATIONS OF LIGHT.

236. Lighting of the Home. W. J. Jones.

El. Rev. 109. *pp.* 566. *Oct.* 16*th*, 1931.

The author deplores the lack of imagination of much house-lighting still being installed, and suggests several ideas for more adequate lighting than the " one ceiling point and one plug per room " now common. The garden could be floodlit with a few hundred watts, and greatly adds to the amenities of the house after dark. Porches, cellars and lofts should be, but often are not lighted. G. S. R.

237. Modern Industrial Lighting. Anon.

El. World. 98. *pp.* 616-7. *Oct.* 3*rd*, 1931.

Shows seven photographs of lighting installations in various American factories. W. C. M. W.

238. A Masterful Creation. H. L. James and A. L. Powell.

Light. 2. *pp.* 8-11. *Oct.*, 1931.

A description with photographs is given of the general lighting of the Earl Carroll Theatre. Various novel features are discussed, including a small programme-lighting unit attached to the back of every seat. C. A. M.

239. Permanent Floodlighting at Nottingham. Anon.

El. Times. 80. *p.* 628. *Oct.* 15, 1931.

Gives photographs of the dome and arcade of Nottingham Exchange. The dome is floodlit by 112 1,000-watt projectors, and is visible for some miles. G. S. R.

240. " Preferred Practice " Highway Lighting. Anon.

El. World. 98. *p.* 657. *Oct.* 10*th*, 1931.

Describes an installation for highway lighting erected by the Hartford and Connecticut Power Cos., " in order to demonstrate the advantages of establishing a conventional type of lighting for important motor highways." W. C. M. W.

241. World's Tallest Building. A. Rogers.

Light. 2. *pp.* 26-7. *Oct.*, 1931.

General lighting equipment of the Empire State Building is described with photographs. A feature of the building is the luminous mooring mast, which is 200 ft. high, and the top of which is 1,250 ft. above ground level. Each of the panels in the four sides of the mast is built up of wired glass frosted on the inside, and is illuminated by long vertical runs of 5-watt lamps. C. A. M.

242. Half-Watt Lighting for Engineering Subjects. Richard B. Willcocks.

Brit. J. Photog. Vol. LXXVIII, No. 3730. *pp.* 649-651. *October*, 1931.

243. Portrait Lighting. Anon.

Brit. J. Photog. Vol. LXXVIII, No. 3728. *p.* 614. *October*, 1931.

Both articles discuss the photographic results obtainable with various arrangements of gasfilled lamps. F. J. C. B.

VI.—MISCELLANEOUS.

244. High Lights of International Illumination Congress. " A.U.S. Delegate."

El. World. 98. *p.* 701. *Oct.* 17*th*, 1931.

Gives a brief account of the proceedings of the I.I.C., together with some references to the resolutions passed. W. C. M. W.

245. Ortho-Actinic Light and Highly Transparent Colour Filters. H. Bertling.

Licht-u-Lampe, 20, *Heft* 20, *p.* 295; *Heft* 21, *p.* 307. 1931.

Spectral intensity distribution of photographic light sources, the colour reproduction with their use in black-and-white photography and in colour cinematography is described with examples. For colour photography it is found that various light sources can be combined to suit the special selectivity of different photographic plates. Curves for various combinations of direct and filtered light are given, and the advantages offered by this method are examined. E. S. B.-S.

Exhibits Illustrating Progress in Illuminating Engineering

Exhibits at the Opening Meeting of the Illuminating Engineering Society held in the Lecture Theatre of the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C.

THE exhibits at this meeting, while not quite so numerous as usual, were of a very varied nature and excited considerable interest.

The two opening items were concerned with natural light. Dr. J. W. T. Walsh first exhibited a form of mechanical integrator for the determination of daylight factor, which has been developed at the National Physical Laboratory and has been described in detail by Mr. H. C. H. Townend.* The following explanation of this apparatus has been furnished:—

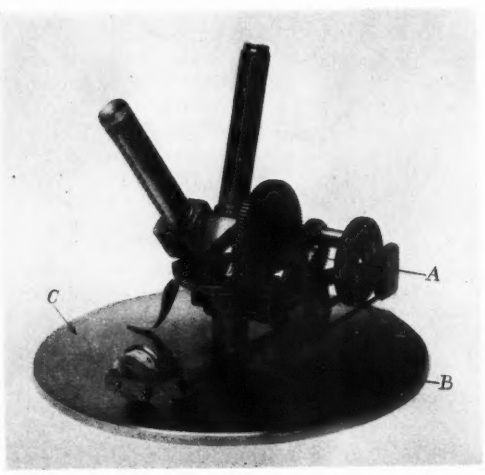


FIG. 1.—General View of Daylight Factor Mechanical Integrator.

MECHANICAL INTEGRATOR FOR THE DETERMINATION OF DAYLIGHT FACTORS.

An instrument has been devised for measuring the illumination of a horizontal surface at any point in the interior of a building due to the daylight received there from windows in the walls or roof. This consists of a universally pivoted telescope, through which the visible sky is observed, placed in the position at which the daylight factor is desired. The telescope is moved so that the cross-wires trace out the skyline. The motions of the telescope are communicated to an integrating wheel in such a way that when a complete circuit of the skyline has been traced, the reading is proportional to the daylight factor at the position occupied by the universal pivot. The instrument will cover the whole sky, and calibration consists in setting the telescope to 90° elevation and obtaining a reading, N_0, by turning through 360° horizontally. This corresponds to a completely unobstructed sky and a daylight factor of unity. The daylight factor in any particular case is then given by dividing the reading, N, by N_0.

The instrument is, in effect, a mechanical means of performing the integration:—

$$\int c\ (1 - \cos 2\theta)\ d\phi,$$

where θ is the angle of elevation and ϕ the angle of azimuth of a point on the skyline, and c represents one circuit of the skyline.

* *Journal of Scientific Instruments*, Vol. VIII, No. 6, June, 1931.

THE WALDRAM DAYLIGHT FACTOR GAUGE.

Mr. P. J. WALDRAM has kindly furnished us with the following detailed description of the first of these two instruments, the Waldram Daylight Factor Gauge.

This instrument is a new development from the apparatus described in the paper read before the Illuminating Engineering Society by Messrs. P. J. and J. M. Waldram in 1923.*

The object of the instrument there described was to reduce the labour involved in setting up geometrical projections for the purpose of calculating the daylight factor enjoyed at any position in an interior from patches of sky visible from that position through external openings over and beside irregular obstruction. In its original form it consisted merely of an ordinary camera used with a fixed focus and having a web of lines traced or etched on the ground-glass focussing screen. When placed at any point in an interior at which it was desired to measure the daylight factor provided by any area or areas of visible sky the lens could be so directed towards the opening, generally a window, that an image of the area of sky visible through it was formed on the ground-glass focussing screen. This image was thus automatically superimposed on the transparent web of lines. The web of lines constituted the image which would have been formed on the focussing screen had there been placed in front of the lens a wire cage in the form of a quarter-sphere, with its centre at the optical centre of the lens and its base horizontal. If the wires of the cage consisted of parallel horizontal rings of known angular vertical elevation from the horizontal and vertical radial rings of known horizontal deviation from the axis of vision, then obviously any view photographed through such a cage would act as a photographic theodolite and automatically register the angular co-ordinates of a number of points on the view photographed.

The general forms of the cage may be appreciated from the flat projection of it shown in Fig. 2. Its image on a photograph or a focussing screen takes the very unexpected form of Fig. 3.

When a hyperbolic web, such as Fig. 3, is superimposed over either the image on the focussing screen or on the photographed picture, the angles of altitude and azimuth subtended at the optical

* *The Illuminating Engineer*, Vol. XVI. Nos. 4–5, April–May, 1923.

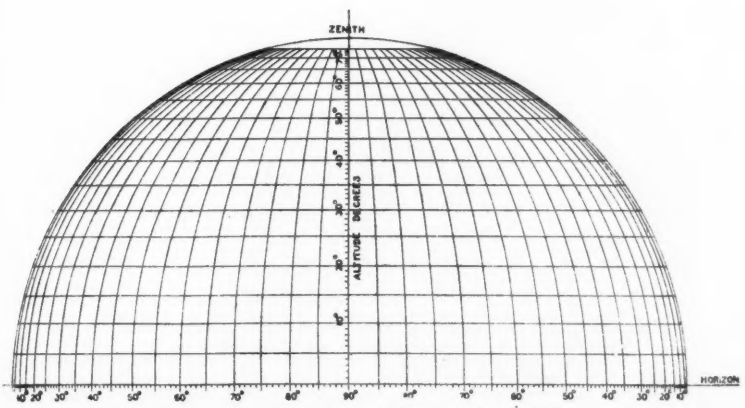


FIG. 2.—Flat Projection of Quarter-sphere of Sky.

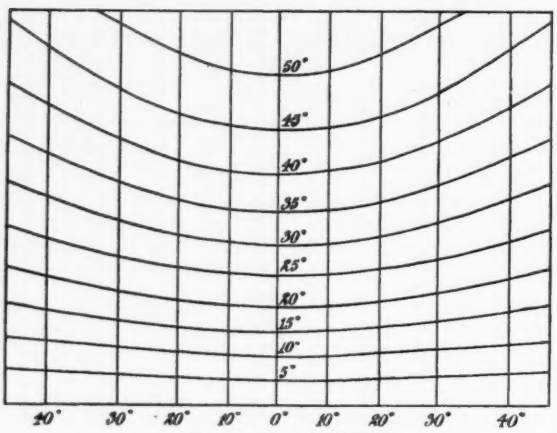


FIG. 3.—Hyperbolic Web.

centre of the lens by salient points on the boundaries of any visible sky can be read off directly. The accuracy with which this can be done depends merely upon the closeness with which the hyperbolic web is divided.

The boundaries of the area of visible sky, however irregular it might be, can then be transferred either to an ordinary flat projection of a quarter-sphere, as Fig. 2, if it be desired to ascertain the periods of possible sunshine reaching the position under investigation, if it be desired to measure the daylight factor of illumination on a vertical plane; or on to a Waldram Calculating Diagram, as Fig. 4, from which the daylight factor on a horizontal plane, such as a table or desk, can be measured. By photographing through a screen permanent records can be preserved. In actual practice, however, this attractive labour-saving device proved to have little or no scope of useful work. In the course of a fairly extensive practice in disputes between neighbours as to light, it has only been employed twice in eight years.

What was required, however, in many cases, was some simple instrument, capable of being used by any unskilled but moderately intelligent person, which would quickly determine whether the daylight factor at any given position in an interior suffering from irregular obstruction were above or below any given value; or alternatively would enable the position of iso-daylight factor contour lines across the interior to be determined without calculation or geometry. For example, the windows of many old-fashioned church schools are obstructed by architectural features in neighbouring buildings, which is seldom feasible to measure, and the situation is often further complicated by ornamental (*sic*) tracery in the windows themselves.

The labour of ascertaining which desks comply with the minimum requirement of 0.5 per cent. daylight factor by graphic methods is generally prohibitive, whilst photometric exploration can only be effected in suitable weather. In consequence, proper systematic surveys of the lighting of school places is seldom or never undertaken; and many children are educated under conditions of perpetual twilight, which might often be remedied at slight cost if both the defects and their causes could be examined with less difficulty. Also expensive disputes between neighbours as to light can often be prevented by a timely appreciation of the facts. Anything which effects a reduction of the labour of ascertaining those facts is desirable.

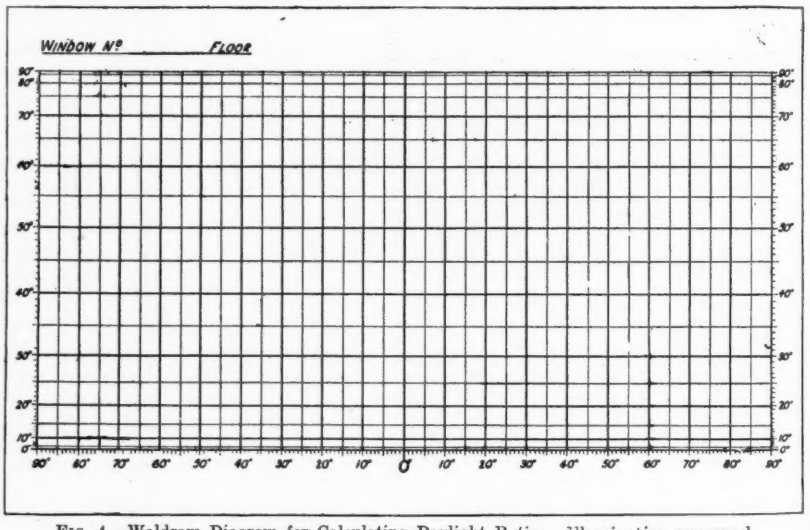


FIG. 4.—Waldram Diagram for Calculating Daylight Ratios. Illumination measured vertically on horizontal surfaces.

The simple instrument shown in Figs. 5 and 6 was therefore devised to meet this need. It is essentially an ordinary camera with a lens (1) of fixed focus and a ground-glass focussing screen (2). For the purpose of taking observations more conveniently on tables, desks and flat surfaces, not necessarily horizontal, it is fitted with an ordinary 45° prism (3) which serves several useful purposes. It enables the focussing screen to be inclined when the instrument is place on the plane under consideration, and the observer to view it in a natural and convenient

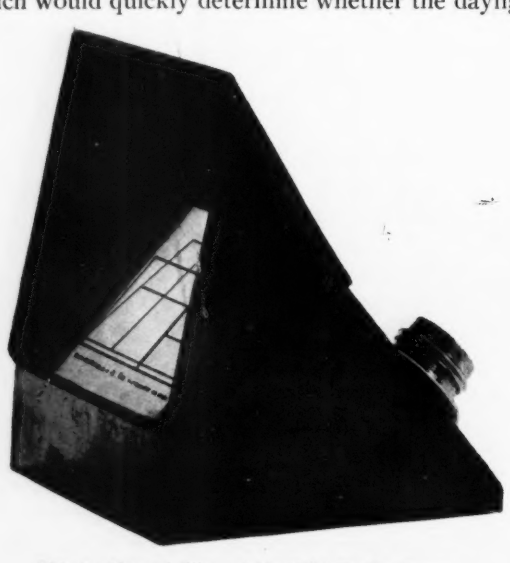


FIG. 5.—General View of Daylight Factor Gauge.

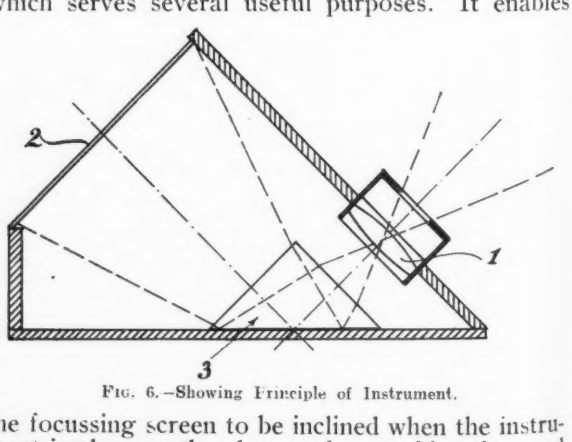


FIG. 6.—Showing Principle of Instrument.

attitude. It makes sure of the important upper part of a window being included in the field of view, and it enables the image on the screen to represent the sky visible from and therefore illuminating the plane upon which the instrument rests.

The image on the focussing screen can be viewed through transparent webs of lines. These can either be the true perspective view of Fig. 7 through the imaginary cage of angular co-ordinates, which,

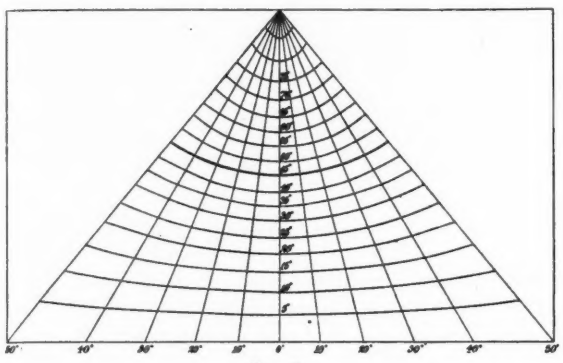


FIG. 7.

at an inclination of 45°, replaces the hyperbolic web of Fig. 3, or a series of figures of different proportions, each of which represents as much of the web as would cover a sufficient area of projected sky to afford to the base of the instrument any given daylight factor. Fig. 8 represents a series of areas

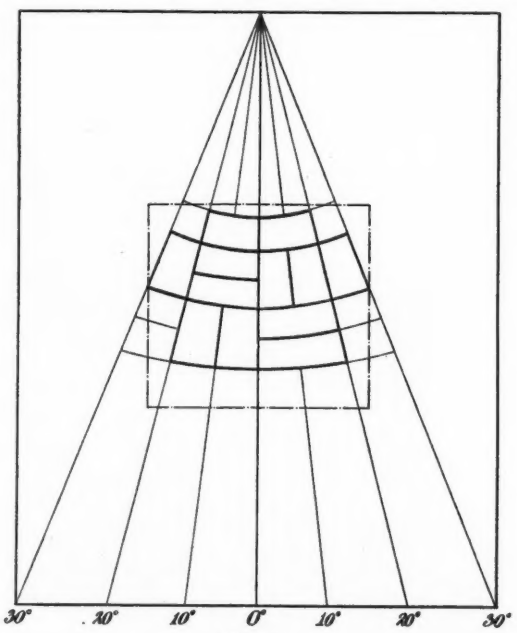


FIG. 8.

each of which affords a daylight factor of 0.5 per cent., the minimum recommended for school desks. Fig. 9 represents a similar web of areas equivalent to 0.5 with the instrument used on its side to pick up low-angle sky. Similar webs are used for any other value of daylight factor.

It is found to be possible to judge with close accuracy whether a patch of visible sky seen in the image on the ground-glass screen is greater or less than an area in the web through which it is viewed. Two positions of the instrument on a table or a school desk at which a given patch of sky appears respectively definitely larger or definitely smaller than one of the superimposed or adjacent squares are seldom separate by a distance of more than an inch or two.

The instrument has the advantages of being extremely simple, light and handy. Its use involves no technical knowledge or photometric training, and is very rapid. Unlike the photometer, it is not confined to obstructions actually in being. It is independent of weather, and can be used on large-scale

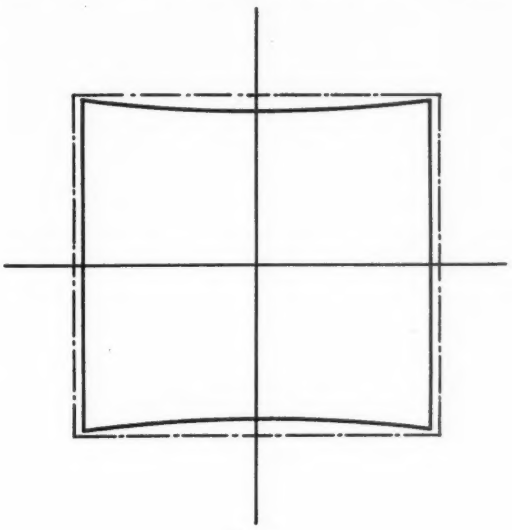


FIG. 9

models. If any proposed increase of an existing obstruction be indicated by scaffold poles and cords, these appear in the image, and their effects can be seen in reduction of visible sky area, and the altered disposition of areas of adequate and inadequate light in any interior affected can be set out in the form of contour lines.

The improvement of a poorly lit interior by removal of existing obstructions can similarly be ascertained with accuracy and dispatch. For example, a church school may be lit by pointed Gothic windows or obscured by unnecessary sham tracery. A few minutes' work with the instrument would indicate at once not only which desks are inadequately lit, but whether they would be adequately lit if the windows were altered to square heads taken up to the ceiling—such would often represent a comparatively simple structural alteration well within the capacity both of the local builder and of the local funds. The glass plate screen can, of course be replaced if desired by a photographic film or plate, and photographic records obtained of the image with the hyperbolic or other web superimposed.

In what follows we give a summary of Mr. Waldram's description of the Sunshine Gauge, which is, of course, of primary importance to architects, but is also of interest to illuminating engineers.

THE WALDRAM SUNSHINE GAUGE.

The amount of possible sunshine reaching any given spot, e.g., a position on a room, can be ascertained by setting up geometrical projections of the sky-area visible from that position, and tracing across them the apparent paths of the sun upon typical dates. If the apparent sun-paths be divided by markings indicating the time of day at which the sun apparently passes points upon each sun-path, as in Fig. 10, it is easy to calculate the duration of possible sunshine at the point considered. A description of the method of preparing such diagrams has already been given.*

If a sufficient number of positions be thus studied, contour lines of possible sunshine, representing the average of weekly, monthly, yearly, or other seasonal periods may be set out. By reference

* *Illum. Eng.*, Vol. XVI, April-May, 1923, and elsewhere.

to available metereological data *probable* sunshine may also be plotted in the form of calculated average percentage of possible sunshine for any district in Great Britain, based on official observations over a period of 31 years.

This process is of obvious value to architects. For example, it may reveal that whereas the conventional design of hospital ward gives a daily average of, say, two hours of sunshine on the foot of each bed, the period would be much extended by a more judicious design. The process of calculation is, however, tedious, and the sunshine gauge illustrated in Fig. 11, which is simple in operation, has therefore been devised.

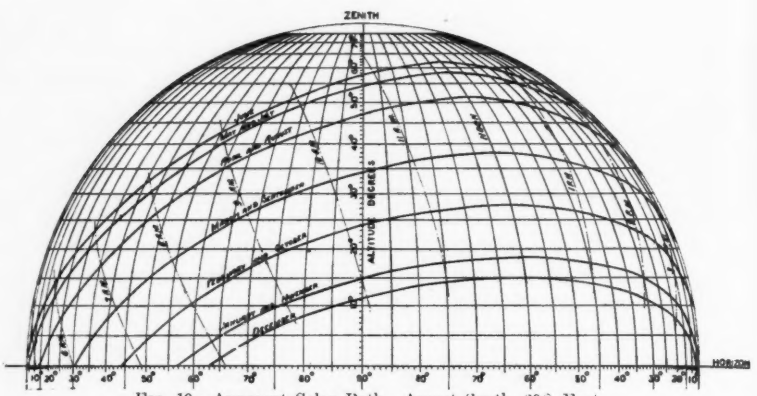


FIG. 10.—Apparent Solar Path. Aspect South, 30° East.

The instrument consists essentially of a small mirror, which can be brought to an exactly horizontal position. Partially encircling the mirror is a web of transparent celluloid etched with lines marked January, February, etc., and crossed by

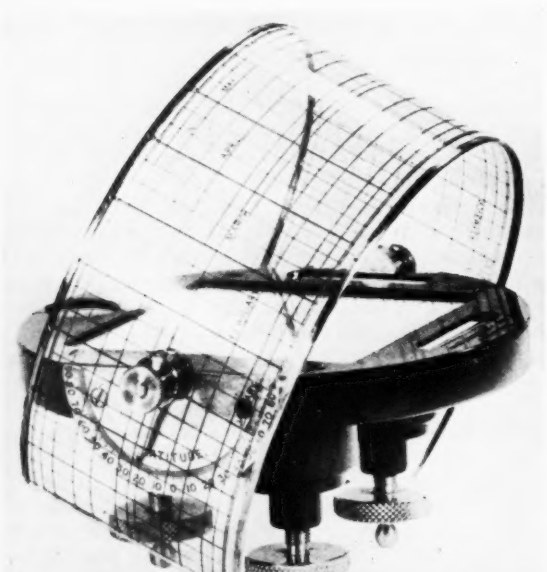


FIG. 11.—General View of Waldram Sunshine Gauge.

transverse lines marked with hours, 11 a.m., noon, 1 p.m., etc., the hourly period being further subdivided into periods of 20 minutes. This transparent web can be set at any desired angle of inclination to the mirror. Mr. Waldram explained in detail just how this apparatus can be applied in practice, pointing out that it is not necessary to wait for the sun to be shining on a particular day. It is not even essential that the instrument should see actual sky. It can be used with scale models of rooms, which can be utilized by artificial light in the drawing office.

Mr. Waldram's description of this interesting device, which was illustrated by numerous lantern slides and diagrams, was listened to with close attention, after which Mr. L. E. BUCKELL was asked to demonstrate several recent developments in connection with electric incandescent lamps, and other exhibits dealing more particularly with progress in lamps and fittings followed.

ELECTRIC LAMPS WITH "COILED-COIL" FILAMENTS.

Mr. L. E. BUCKELL showed two new types of electric lamps, illustrating interesting developments in the technique of lamp manufacture.

The first was a projector lamp required for use with home cinemas in which the small size of the film picture (11 mm. by 8 mm.) and the consequent small diameter of the lens, necessitated a lamp with a particularly small light source. On the other hand, the fact that the apparatus was required for use on voltages of 115 and over necessitated a long thin filament.

The small light source was obtained by first spiralling the wire which was only .042 of a mm. in diameter and some 300 mm. in length, and again coiling the resultant spiral on a rather larger mandrel. This gave a coiled-coil not more than 15 mm. long which was then arranged in three parallel pillars so giving a grid about $4\frac{1}{2}$ mm. square.

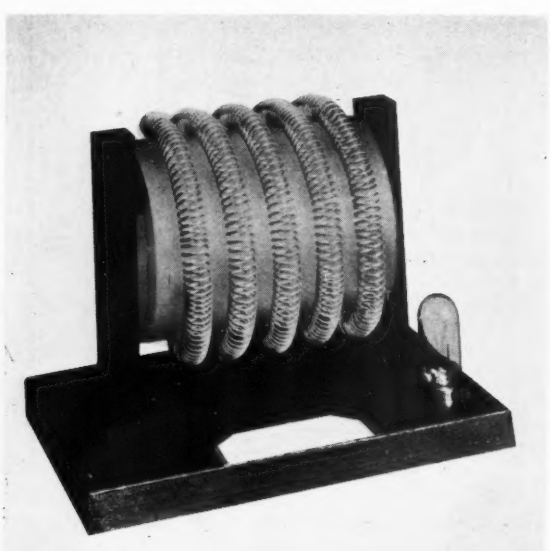


FIG. 12.—A Model showing nature of "Coiled-Coil" Filament, with actual lamp visible on the right.

Great skill was required, not only in making the original coil but still more in coiling this into a coiled-coil. Clearances between adjacent coils were of the order of .038 of a mm. The filament, after coiling, was heat treated or tempered so as to set the wire rigidly once and for all. This is the smallest effective projector lamp for use on this high voltage that has so far been produced.

The process of making coiled-coil filaments and of tempering these to obtain rigidity has been applied to a large range of projector lamps with very

beneficial results in avoiding the distortion of the filament in use, such lamps maintaining their light output in a remarkable manner throughout life.

The particular lamp shown was rated at somewhere about 14.5 L/W which involves running the wire at an extraordinarily high temperature, this lamp rated at 115 volts, and consuming 50 watts, being used at the normal efficiency of 115-volt 200-watt lamps.

A New Source of Ultra-Violet Radiation.

The second lamp shown by Mr. Buckell had for its object the production of the shorter invisible wavelengths beyond the violet end of the spectrum, and has been produced to meet the demand for a convenient source of ultra-violet light with, at the same time, a means of filtering out the wavelengths below 2800A which are considered to be detrimental and likely to produce irritation to the eye.

The lamp depends for its function on an ingenious cycle of automatic operations secured by the choice of suitable materials and novel features of design. The bulb is made of a very special glass which permits all wavelengths down to about 2,800A to pass, but traps wavelengths below this.

The short wavelengths are produced by a mercury arc which, when the lamp is in full operation, is maintained in parallel with an incandescent tungsten filament.

The general arrangement of electrodes and filament is shown in Fig. 13: (*a*) being the tungsten filament, and (*b*) the electrodes arranged in parallel with this. At the bottom of the bulb is a small pool of mercury

Fig 13.—General View of Lamp.

On switching on, the filament, with a voltage of 30 volts across it, reaches a high temperature and becomes a source of emission of electrons. The heat from the filament causes some of the mercury to be vaporized and eventually the mercury molecules maintain the arc between the electrodes. The starting voltage is about 30, the running voltage when the mercury arc is in operation being about 10. The change in voltage from the starting conditions to the operating conditions is secured by a transformer designed with special characteristics.

The light from the lamp in full operation gives a spectrum which is practically continuous from about 7,600A to 4,000A, that is to say, throughout the visible spectrum, and is very rich in rays from 4,000 down to 3,100 and contains a considerable proportion of rays at various points between 3,000 and 2,800. It produces erythema corresponding to that produced by the sun after comparatively short exposures and also provides ultra-violet light useful for a variety of other purposes such as the causing of fluorescent paints to glow and in various industrial processes.

Architectural Lighting Exhibits.

Mr. Waldo Maitland then demonstrated several striking examples of decorative and architectural lighting which had been developed at the E.L.M.A. Lighting Service Bureau.

The first of these was a model Colorama designed with a view to obtaining an effect by the application of curved surfaces, and by projecting light upon them one is able to produce gradations of light. At the same time the portions which conceal the lamps are arranged in such a manner that they can be illuminated from other light sources, thereby

Fig. 14.—The Colorama.

giving an impression of continuous lighting effect. The adjacent illustration gives a good idea of the general play of light but of course cannot show the chief feature, i.e., the constantly changing colour-contrasts. This application of decorative lighting could be used with advantage on a large scale in Cinemas, Theatres or Exhibitions. Each light-source contained 24 20-watt lamps, 8 blue, 8 red and 8 green, each on separate circuits so that the change in colour scheme is possible. The total load was 3.8 kw.

The lighting of the Committee Room, next described, is effected by a lay-light installed flush with the ceiling, the light source being mounted above in silvered glass reflectors. The lay-light is glazed with figured rolled glass giving fairly good

Fig. 15.—The Committee Room, illuminated by an overhead artificial skylight.

diffusion, and the reflectors installed give a comparatively even illumination over the upper surface of the glass. The floor area is roughly seven times greater than that of the skylight.

The horizontal illumination at the height of 2 ft. 6 ins. has a maximum variation of about 4.5 to 1, that is from 37 foot-candles to 8 foot-candles, but over the greater part of the area the variation does not exceed 1.75 to 1.

A third exhibit was an ingeniously contrived passage which has been installed to demonstrate the indirect lighting of a barrel ceiling, and also the same system applied to the walls. On the upper cornice 13 25-watt lamps placed 6 ins. apart in porcelain reflectors provide a comparatively even distribution of light on the ceiling surface. The lower cornice, lighting the walls, houses frosted tubular lamps of 30 watts. The cornice lighting involves a total load of 1.7 kw., and the lower cornice lighting and walls 1.02 kw.

Another Form of Sunshine Lamp.

Another novel form of sunshine lamp, shown in the accompanying illustration, was demonstrated by Mr. J. Roberts. This lighting unit comprises a quartz mercury-vapour burner, together with four 100-watt incandescent gasfilled lamps, the whole consuming 1,125 watts and yielding approximately 825 M. hem. sph. candle-power. The two lamps are mounted in a globe of translucent Vitreosil, which gives a soft and diffused light, the contents of the bowl being, of course, completely concealed from view. Whilst, as the above figures indicate, this is an efficient combination, it has also the advantage of yielding a pleasant white light, the blue-green of the mercury arc being balanced by the excess of yellow and red in the spectrum of the incandescent lamps.

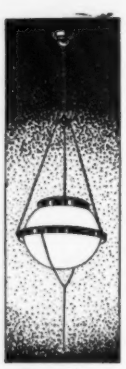


Fig. 16.—The Vitreosil Sunshine Lamp.

It is, however, in the invisible radiation furnished that the chief value of this "sunshine" lamp rests. The mercury arc is, of course one of the richest sources of ultra-violet radiation known, and the spectrum of the luminescent mercury contains components in the "far ultra-violet," which are not desirable for ordinary purposes of illumination. The Vitreosil (fused silica) globe, however, filters out these extreme rays (which, if used without discretion, may have a harmful effect), but allows the beneficial rays in the "near ultra-violet" to pass freely. These sunshine lamps are regarded as specially suitable for use in gymnasia, swimming baths, sanatoria, nurseries, etc., and likewise in basements or workshops where artificial light has to be constantly used or where there is insufficient access of natural light.

The "Vivid-ad" Process of Poster Display.

Members were next treated by Dr. Leonard Levy to a most effective display of posters based on the "Vivid-ad" process, the contrast between the appearance under artificial light and under ultra-violet light radiation being in many cases most arresting.

In what follows we give an account of this process contributed by Dr. Levy.

The "Vivid-ad" processes of poster display employ the varied effects which can be obtained by illuminating posters alternately with ultra-violet light and with ordinary visible illumination, the poster itself being treated with special fluorescent substances. According to circumstances, very varied and beautiful results can be obtained.

In one method of poster display, the appearance of the poster when viewed by daylight is not interfered with. The poster is treated with special fluorescent bodies in such a way that the light emitted by these bodies when excited by ultra-violet radiation is of the same colour as the corresponding portion of the poster when viewed by daylight. For example, a portion of the poster which is red by daylight, emits a red fluorescence when excited by ultra-violet light. The range of fluorescent colours employed has been greatly extended and developed so that every colour and shade can be represented by its fluorescent counterpart. Portions of the poster which are pure white in appearance in daylight can also be made to emit a white fluorescence by night. The production of a body emitting a pure white fluorescence is, in itself, a new development. The poster which has been treated with the special fluorescent preparations is mounted in the ordinary manner, and, if required for use out of doors, is coated with a waterproof varnish.

Another method of demonstration consists of a poster which, when illuminated by visible radiation is black and white. When visible illumination is cut off and the poster is illuminated by ultra-violet light, it exhibits vividly glowing colours of all descriptions.

Yet a third process is a disappearing picture device. In this the poster when illuminated by visible radiation appears black with the exception of certain letters. When illuminated by ultra-violet light a brilliantly coloured image appears. A further method of illumination is a variant of those previously described. In this the poster appears coloured when illuminated by visible illumination, and when illuminated by ultra-violet light some of the colours change, others remain as they are when viewed by visible radiations and others again appear black.

The usual source of excitation is a mercury vapour lamp in a fused quartz burner enclosed in a special weather-proof lantern. The latter is provided with a window composed of nickel glass which is substantially opaque to visible radiations from the mercury vapour lamp, but permits ultra-violet radiations of 3,000-4,000 A.U. to pass with very little absorption. An alternative form of lamp consists of long nickel glass tubes in which the mercury arc is struck. This form of lighting is convenient for small pictures, but the intensity of the illumination is not so great as in the case of the fused quartz burners.

Owing to the fact that the treated posters are themselves emitting variously coloured lights instead of merely reflecting them, their appearance is far more beautiful when viewed by their fluorescent light than when they are seen by reflected light, as in the daytime or by ordinary floodlighting.

A New Type of Projector.

The next item on the programme was the exhibit by Mr. H. H. Long of the Benjamin Duoflux Floodlight which is intended for the floodlighting of open ground areas either alone or in combination with vertical surfaces of buildings. The fact that it is thus designed to furnish downward and forward illumination distinguishes this from the ordinary floodlight projector which is intended mainly for

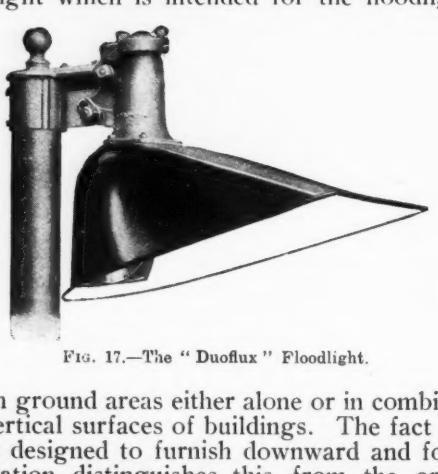


Fig. 17.—The "Duoflux" Floodlight.

FIG. 18.—A Garage floodlighted with "Duoflux" Projectors.

upward illumination. No cover glass is necessary. The fitting is of rugged construction and can be readily mounted on poles.

The chief element of novelty in this projector, however, is that the beam consists of two component parts, one derived from a chromium reflector, which is concentrated, the other from a surface of vitreous enamel which naturally gives rise to diffused light and a very wide distribution. This dual beam enables many complicated problems in light-projection to be solved and special charts are furnished showing how the illumination on horizontal and vertical surfaces may be predicted.

A Miniature Lighting Unit for Sewing Machines.

A second novelty described by Mr. Long was the Benjamin Intensolux Miniature Reflector. This was developed under interesting circumstances. It was discovered that some thousands of 12-volt 6-watt lamps are used on adjustable standards for the supplementary lighting of sewing machines and numerous other small machines. Such low voltage supplementary lighting is considered very advantageous from the standpoint of safety. Apparently,

FIG. 19.—The Miniature "Intensolux" Reflector.

however, there was available no efficient reflector suitable for lamps of this description. Accordingly a parabolic type of reflector of solid aluminium has been designed. The highly polished surface is protected by a hard bakelite lacquer, but as a special protection in cases where dust is excessive clear glass covers can be provided. In view of the variations met with in small B.C. lamp holders and also with a view to provision of focussing facilities the method of attachment of the reflector was specially studied and difficulties were overcome by an ingenious mounting device, described in detail at the meeting. The reflector can be applied to other standard 12-volt lamps, i.e., those of 4 and 9 watts. The Miniature Intensolux is $3\frac{3}{4}$ ins. in diameter and $2\frac{7}{8}$ ins. in height. It is particularly acceptable as a source of extra illumination at the needle of a sewing machine, and in other cases where overhanging parts of machinery tend to diminish the illumination at the essential point to below the average, whereas of course it is just at these points that the illumination should be a maximum.

Lighting of the Manchester-Altrincham Electric Railway.

Mr. R. C. Hawkins gave an account of the lighting of this railway, which runs from London Road Station, Manchester to Altrincham, and is jointly owned by the L.M.S. and L.N.E. Railway Companies. The railway has been in operation for many years, but was recently electrified, the new system being put into operation in May of this year. This electrification aroused great interest in engineering circles, for it is the first to be carried out in this country to the new standard adopted by the Ministry of Transport, the line voltage being 1,500 D.C., with overhead collection. The distance between termini is $8\frac{1}{2}$ miles, and there are ten intermediate stations.

The principal lighting features are as follows, and while they do not represent any advance technically, certainly mark a big step forward in suburban railway practice.

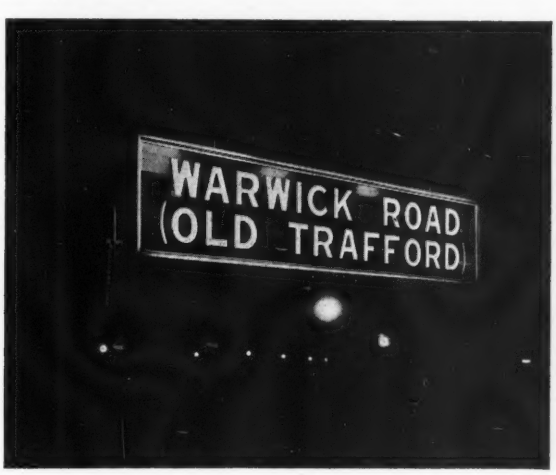


FIG. 20.—One of the Illuminated Station Name Plates on the Manchester-Altrincham Electric Railway.

Lighting of Compartments.

Each compartment is of standard dimensions, and is lighted by means of two series-burning Pearl lamps consuming 0.6 amps. at 110 volts. The holders are recessed into the ceiling, so that the whole ceiling surface is utilized as a reflector. Tests taken in several compartments indicate an average of 8 foot candles on the normal reading surface, with very little variation.

Destination Indicators on Trains.

Each train is provided with a lighted indicator at each end, showing its destination. These consist of the usual canvas transparencies illuminated from behind.

Station Name Boards.

Each station is provided with a number of name boards consisting of white letters approximately 12 ins. high on a black background, and illuminated by 100-watt lamps in angle reflectors. The number of reflectors varies according to the length of the name, but is in no case less than two. The accompanying picture illustrates one of the boards, three reflectors being used in this case. The majority of stations have similar boards placed over the station entrance, which makes them readily visible from a considerable distance along the approach.

Train Stop Indicators.

The larger stations are fitted with lighted indicators showing stopping places for each train, and are of standard box-sign construction.

Station Lighting.

Until the electrification all stations were lighted by gas, but this has now been replaced by 100-watt Pearl lamps in vitreous-enamelled extensive reflectors. The improvement has been very marked, and has caused great comment amongst the large number of passengers using the line. The service has been speeded up very considerably, the schedule time for the complete trip for trains stopping at all stations being 21 minutes. There is no doubt that the improved lighting facilities have assisted very considerably in this speeding-up, as well as adding a great deal to the comfort of the passengers.

A Novel Silhouette Sign.

Mr. S. L. Calvert (Siemens Electric Lamps and Supplies Ltd.) exhibited the "Briteback" Silhouette Sign. The special features of this sign, of which illustrations are appended, are:—

(1) The excellent visibility is obtained both by day and night, resulting in 100 per cent. publicity.

(2) The letter characters stand always in cold relief against a contrasting background, i.e., in "silhouette" letters, showing in gilt or any colour by day and as a black silhouette at night—with white, coloured or bright metal sides visible from a very acute angle when illuminated.

(3) The letter characters are very easily and quickly changed—by employing a very simple system of clips, making it possible, by means of spare letters, to spell out any combination of words (within the limits of the sign length).

(4) By utilizing white or colour-sprayed lamps in the troughing or box container, an excellent "background" is obtained, while if the colours are mixed a very pleasing and attractive appearance is given as a "rainbow" effect.

(5) If flashers are used, the "background" is given "life" or "movement," which, of course, means a very definite attraction to the passer-by, due to the natural tendency of the eye to observe intermittent light more readily than a stationary source of light.

(6) Primarily the sign is intended for use on facias—canopy skirt facias—notice boards, and shelters, and can be employed in many other situations.

Fig. 21.—Showing the "Silhouette" Effect of the "Briteback" Sign.

(7) The standard sizes of letters for facias and canopies, etc., are in a range up to and including 24 ins., while for notice boards, etc., very small letters, from say 1 in. upwards, can be supplied.

Fig. 22.—Another view showing the ease with which letters can be changed.

Lighting at the Colonial Exhibition, Paris

BY the courtesy of "B.I.P.," the bulletin isued jointly by the *Société pour le Développement des Applications de l'Electricité* and the *Société pour le Perfectionnement de l'Eclairage*, we are enabled to present the accompanying views of some of the original fittings adopted at the Colonial Exhibition in Paris.

The decorative lighting of this Exhibition was confided to two eminent architects MM. Granet and Expert, who set themselves to design fittings such as would, (1) avoid completely all bright spots of light, (2) present no similarity to industrial models, and (3) exhibit an exotic appearance in keeping with the architecture of the various sections of the exhibition which they served to illuminate.

FIG. 1.—"Lotus" Fittings on the edge of the Lac Daumesnil.

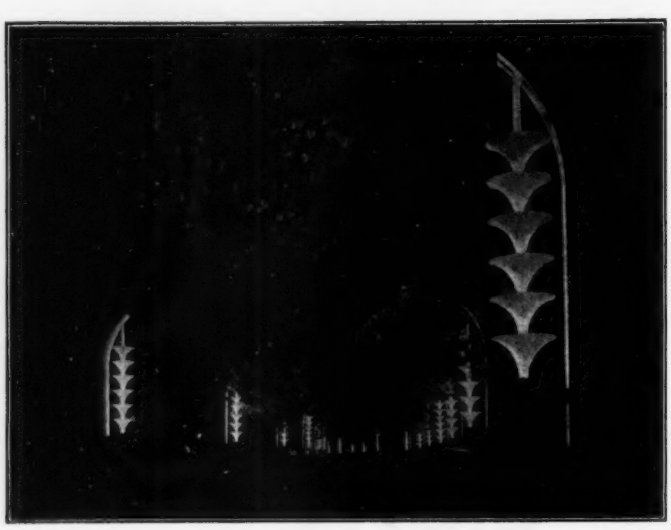


FIG. 2.—Conical Chain-fittings, serving to illuminate an Avenue.

It was felt that in order to satisfy condition (1) completely, indirect methods of lighting must necessarily be used, but the methods of applying indirect light involve the design of novel types of fittings. In Fig. 1 we have a "lotus" type of indirect lighting fitting applied to illuminate pathways at the edge of the lake (in other parts of the exhibition this idea of imitating flowers, weapons, types of animal life, and even indigenous buildings has been carried out) In Fig. 2 we have the "chenille." This fitting, likened to a worm or caterpillar, consists of a series of inverted cones, each receiving light from lamps concealed at its apex. In Fig. 3 the idea of imitating weapons is exploited. The lighting fitting here shown consists of two shields or bucklers placed back to back, each receiving light from a lamp mounted at the point of the buckler but concealed by a small reflector, so that the whole forms an indirect source. In some sections of the Exhibition the more familiar idea of illuminating avenues by means of luminous pylons was adopted, whilst other indirect fittings, mounted amidst foliage bore a resemblance to native huts and pagodas.

The Lighting of the Colonial Exhibition is thus distinctive and unusual. Whilst the modern tendency at exhibitions is to make fuller use of floodlighting and one sees nowadays less of the uninspired outlining of buildings with incandescent lamps, there is still a certain tendency to glare in the methods of general lighting. It is not always realized how greatly decorative effects due to concealed lighting gain when the sources used for general lighting are completely screened from view, as was apparently the case at the Colonial Exhibition.

FIG. 3.—"Shield" Fittings. Two shields or bucklers, placed back to back, receive illumination from screened lamps at the point of each shield.

Lighting the Faraday Exhibition

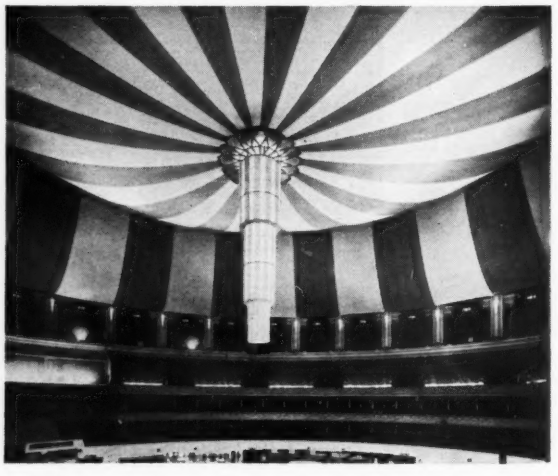
(Communicated.)

One of the most interesting features of the recent Faraday Exhibition at the Albert Hall was undoubtedly the original nature of the lighting scheme, which was designed by Mr. Waldo Maitland, A.R.I.B.A., architect to the Lighting Service Bureau. Suspended from the dome of the Albert Hall were a number of steel cords, supporting a valarium composed of 80,000 square feet of material. This was caught up into swags of alternate cream and yellow.

Beams of light from 200 concealed floodlights, each of 1,000 watts, stationed round the gallery were trained on to the valarium, and the resultant reflected light was almost completely shadowless. At the apex of the valarium was suspended a large fitting 40 ft. deep by 10 ft. in diameter. This was supplemented by 32 brackets placed on the columns at the gallery level. The simplicity of the scheme was due to the large area of the reflecting surface and limitation of the number of point sources.

The casual visitor to the Faraday Exhibition, impressed by the magnificent scheme of lighting, was apt to think it a wonderful *tour de force* on the part of the electrical industry, and too prohibitively expensive for any normal exhibition. The truth is that, assuming current to be supplied at an outside figure of 1d. per unit, the lighting of the Albert Hall would cost less than £1 per hour. Compare this with the total cost of the exhibition, which was in the region of £20,000, and it will be seen how relatively insignificant was the cost of lighting. It was no more, in fact, than the wages of a few additional attendants.

In view of this comparison, it is not unreasonable to suggest that, in future, exhibitions should be lighted to something approaching the standard at the Albert Hall, when an illumination of about 15 foot-candles was provided. The benefit to the public is obvious in a greater feeling of comfort; the benefit of the exhibitor is equally obvious in that his goods can be viewed and appreciated to greater advantage. The benefit to the promoters would surely follow immediately in increased attendances.



A General View of the Valarium and Central Fitting.

The following data regarding the equipment may be of interest:—

Lighting of the Valarium: Two hundred 1,000-watt floods, 200 kw.

Central Fitting: Fifty-four 500-watt clear lamps.

32 *Brackets*, each containing five 100-watt Pearl lamps, 16 kw.

Total load: 243 kw

INDEX (December, 1931).

TRADE NOTES & ANNOUNCEMENTS

Electioneering by Gas

RESULTS OF THE I.I.C.

As a result of the very successful floodlighting carried out in September by the Gas Light and Coke Company in St. James's Park, this type of lighting is rapidly achieving popularity. In Stoke Newington, the Conservative candidate applied to the same company for the loan of some floodlighting equipment for the Conservative Committee Rooms. This was duly installed, and the very next day the Labour candidate—also a woman—not to be outdone, followed suit.

The installation shown consists of three gas floodlights with parabolic reflectors similar to those used in St. James's Park. There is a 10-light lamp at each end and a 12-light lamp in the middle, and all are effectively hidden behind the paling in the foreground.

That the public have begun to appreciate the possibilities of floodlighting for such a great variety of purposes is a welcome indication of the good that was done by the I.I.C. this year.

International Illumination Congress

A small quantity of the copies of the Guide to Cambridge, prepared for the International Illumination Commission, and a number of copies of the History o the International Comission on Illumination are available, free of charge, to any reader. Application should be made to Col. C. H. S. Evans, International Illumination Congress, 32, Victoria Street, London, S.W.1.

Floodlighting for the new Wimbledon Town Hall

The floodlighting of the new Town Hall, Wimbledon, was carried out by the Electricity Department, under the direction of Mr. A. E. McKenzie, the Borough Electrical Engineer, in collaboration with

Messrs. Holophane Ltd. The frontage of the whole of the Municipal Buildings was treated. In all, 43 projectors, each using a 1,000-watt lamp, were required. Various vantage positions were chosen around this building, which necessitated different angles and lengths of throw, and demanded special optical equipment.

The accompanying night photograph of the Town Hall, taken and published by the courtesy of Messrs. Holophane Ltd., gives an excellent impression of the effect obtained, and illustrates the uniform illumination achieved. This is a typical instance of the development in floodlighting resulting from the I.I.C. display last September.

BRITISH PATENT.

The Proprietors of the British Patent No. 291238, relating to Improvements in and relating to Decorative Devices, are desirous of entering into negotiations with one or more firms in Great Britain for the purpose of exploiting the above invention, either by the sale of the patent rights or by the grant of a licence or licences to manufacture on royalty. Inquiries should be addressed to Abel & Imray, 30, Southampton Buildings, London, W.C.2.

"Colonel Cris Elco"

Amongst the publicity literature issued by electric lamp companies during recent months some of that prepared by Cryselco Ltd. deserves a special word of commendation. "Colonel Cris Elco" is, as usual, well to the front, but we think that on this occasion he has surpassed himself. The showcard that has just reached us, featuring the gallant Colonel seated amidst a series of Cryselco lamps with a silver and red background, is one of the most striking that we have seen.

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